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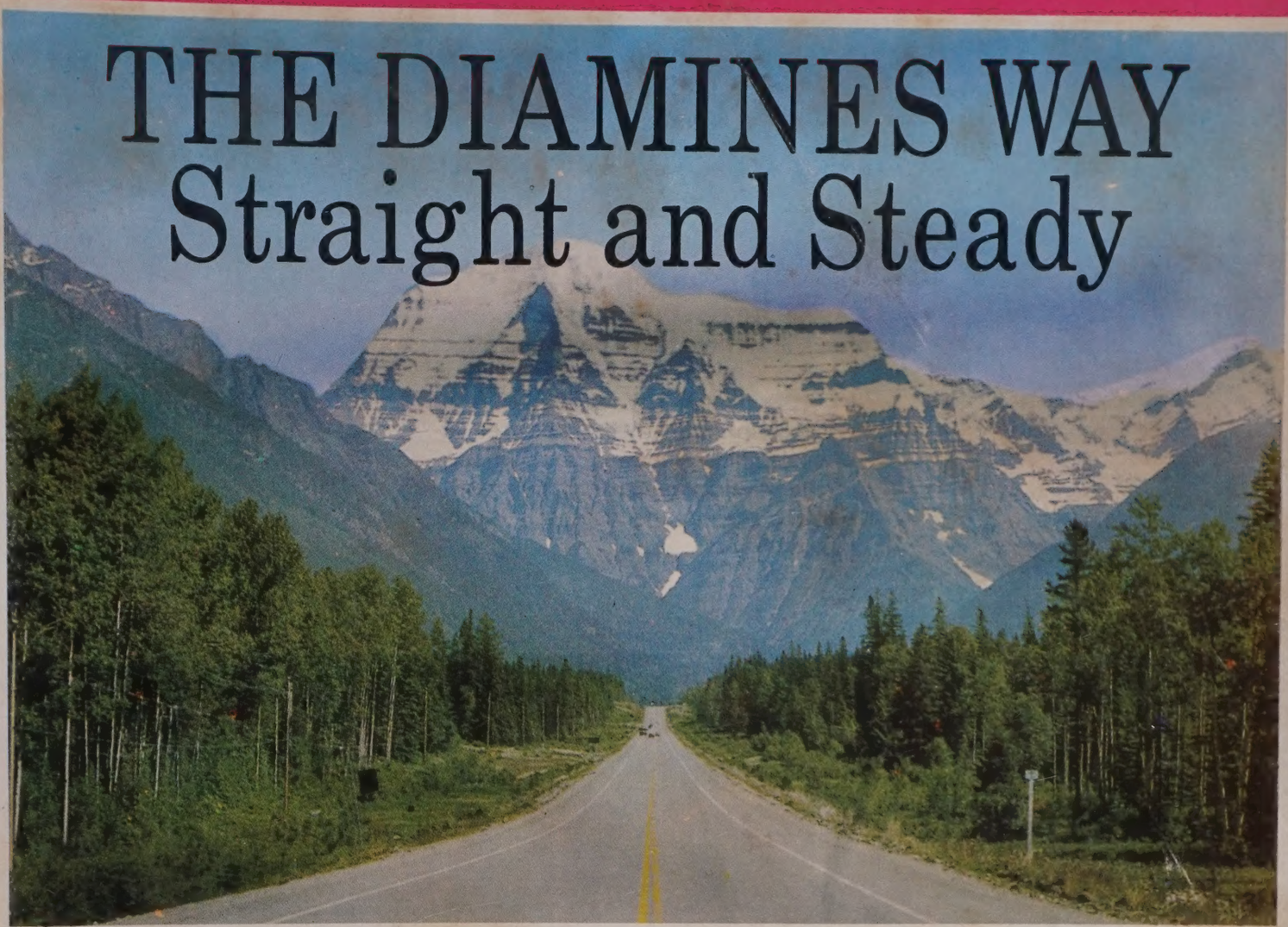

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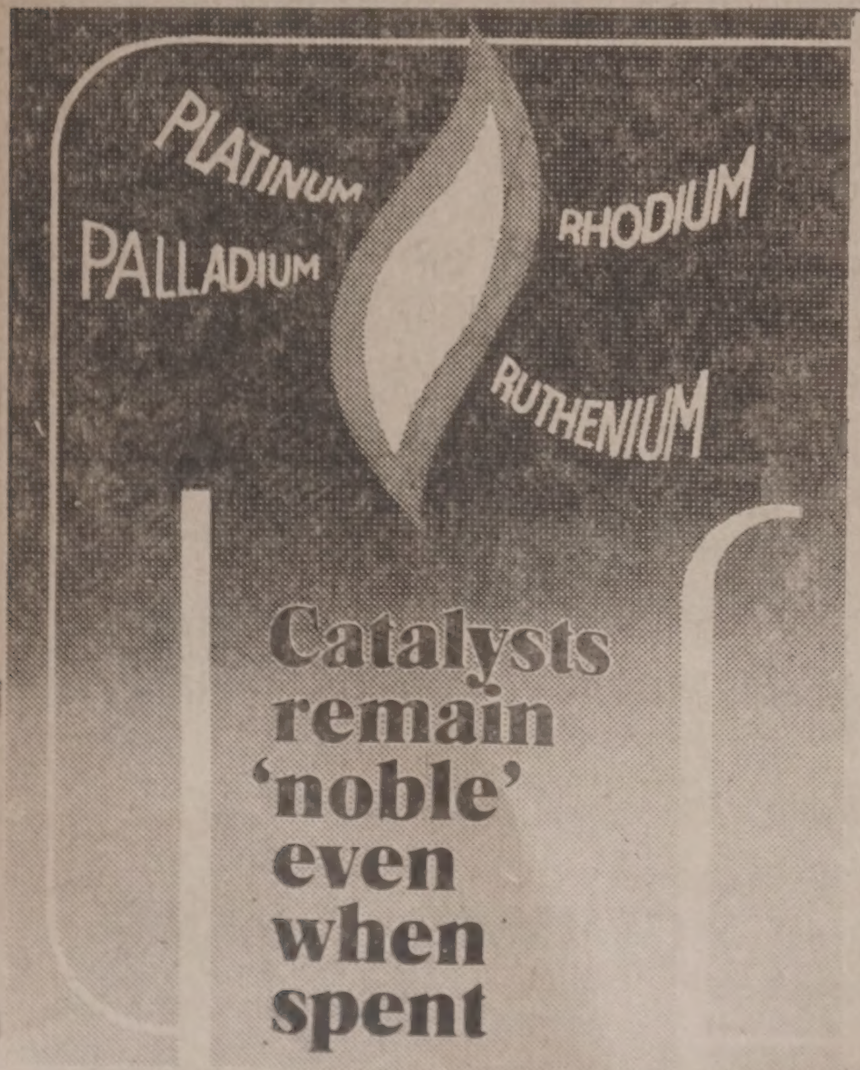

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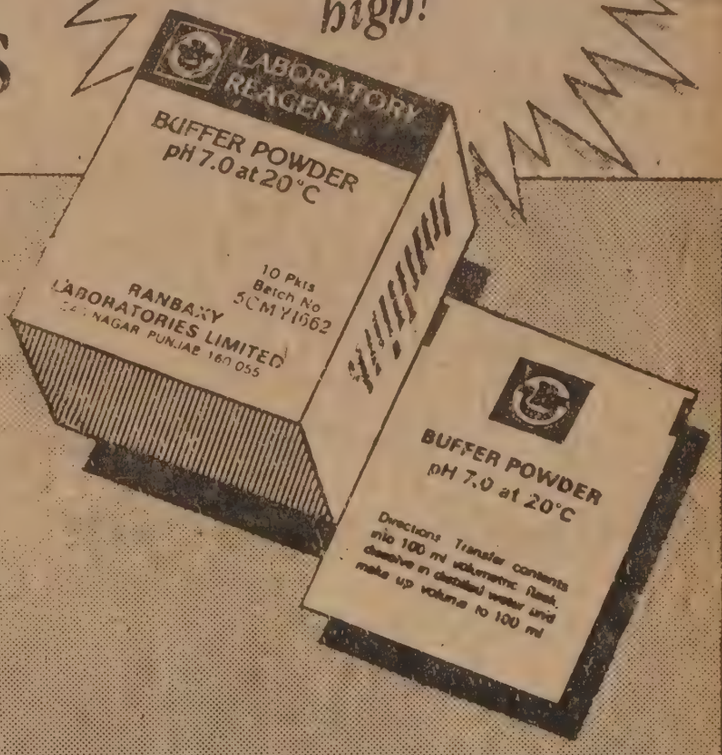

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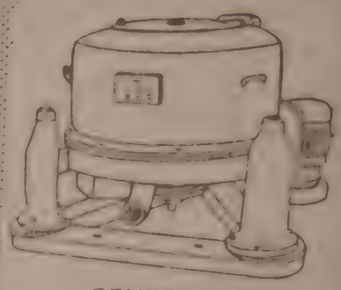
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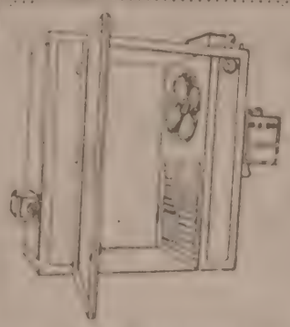
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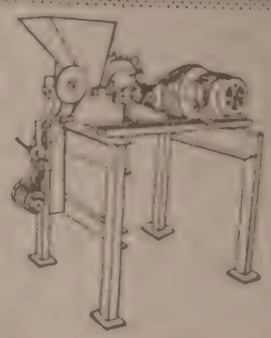
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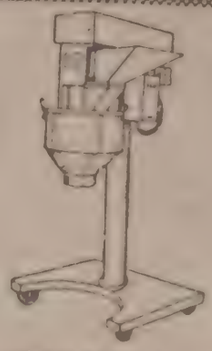
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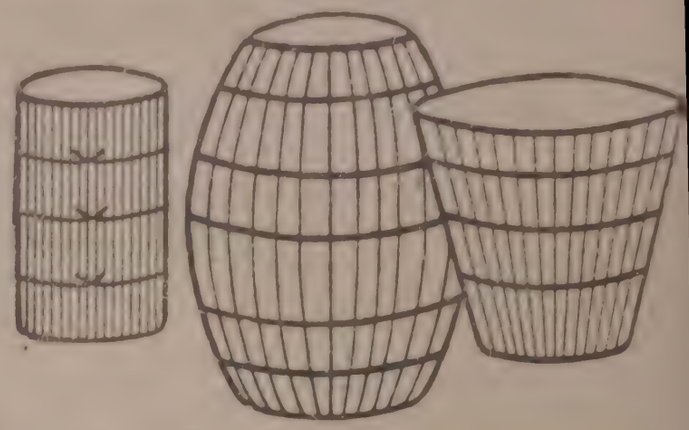

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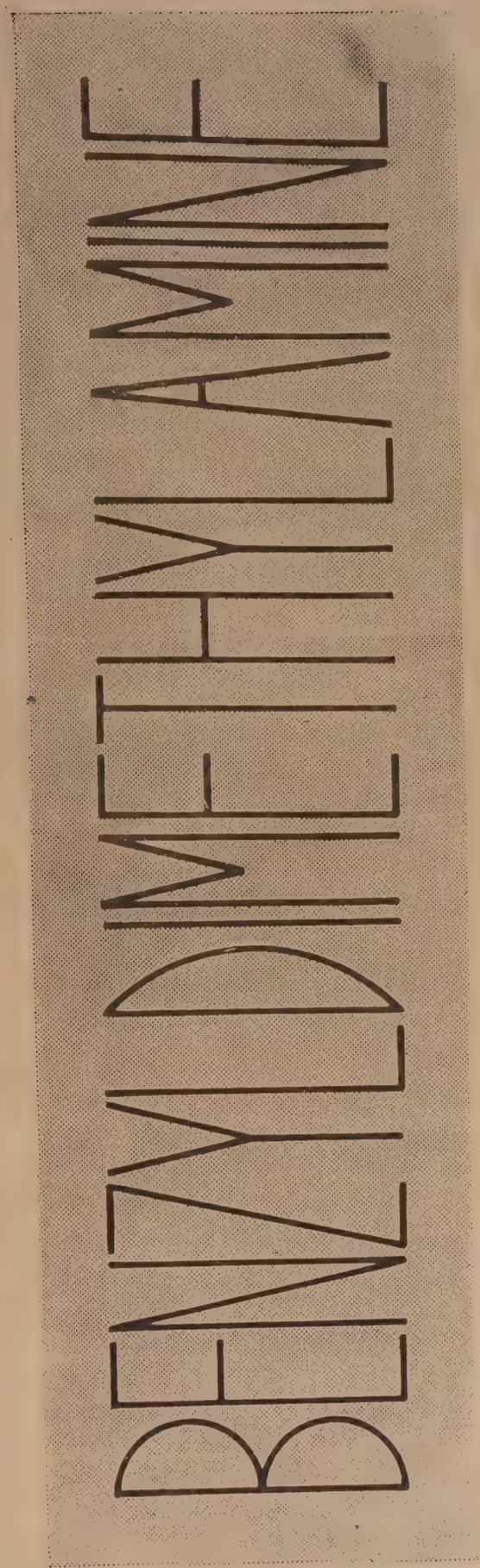

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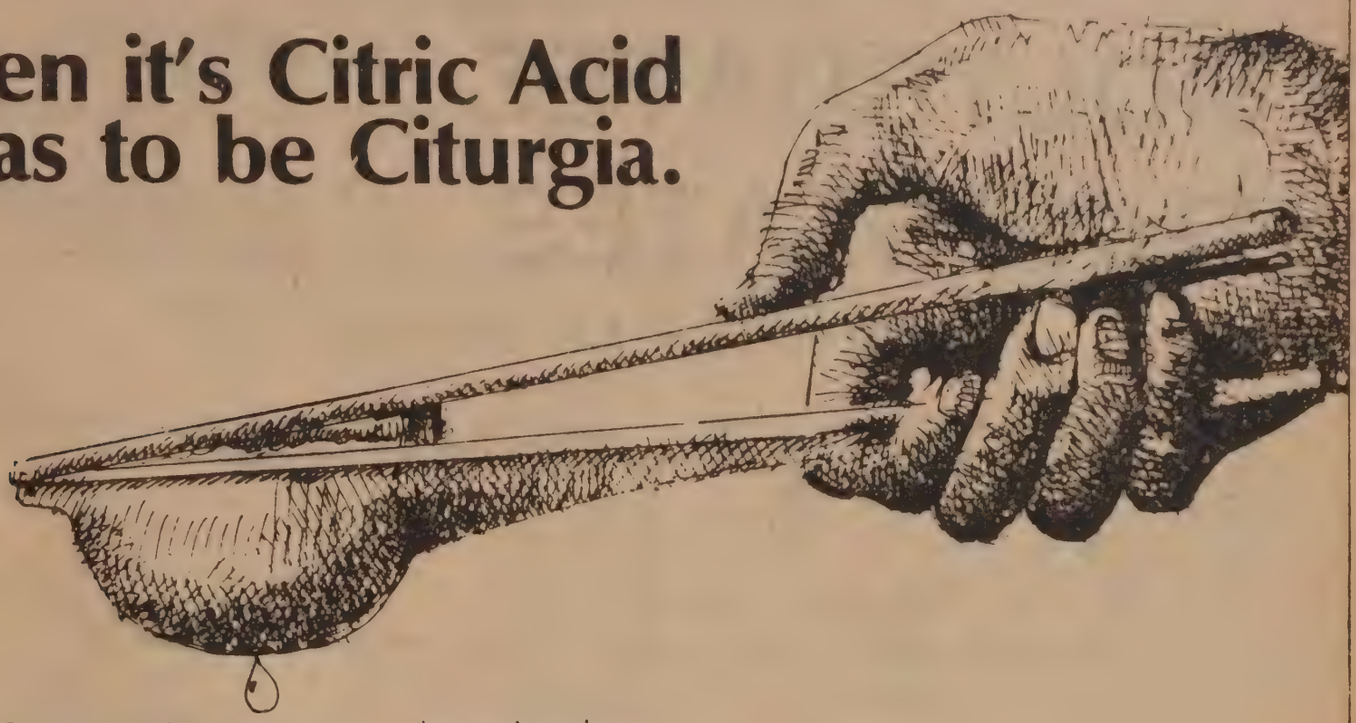

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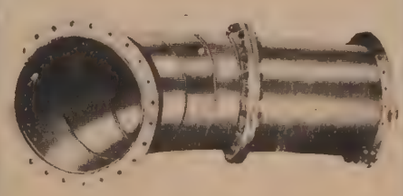
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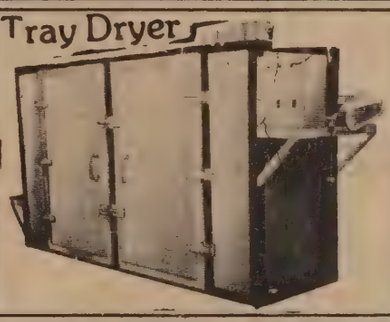
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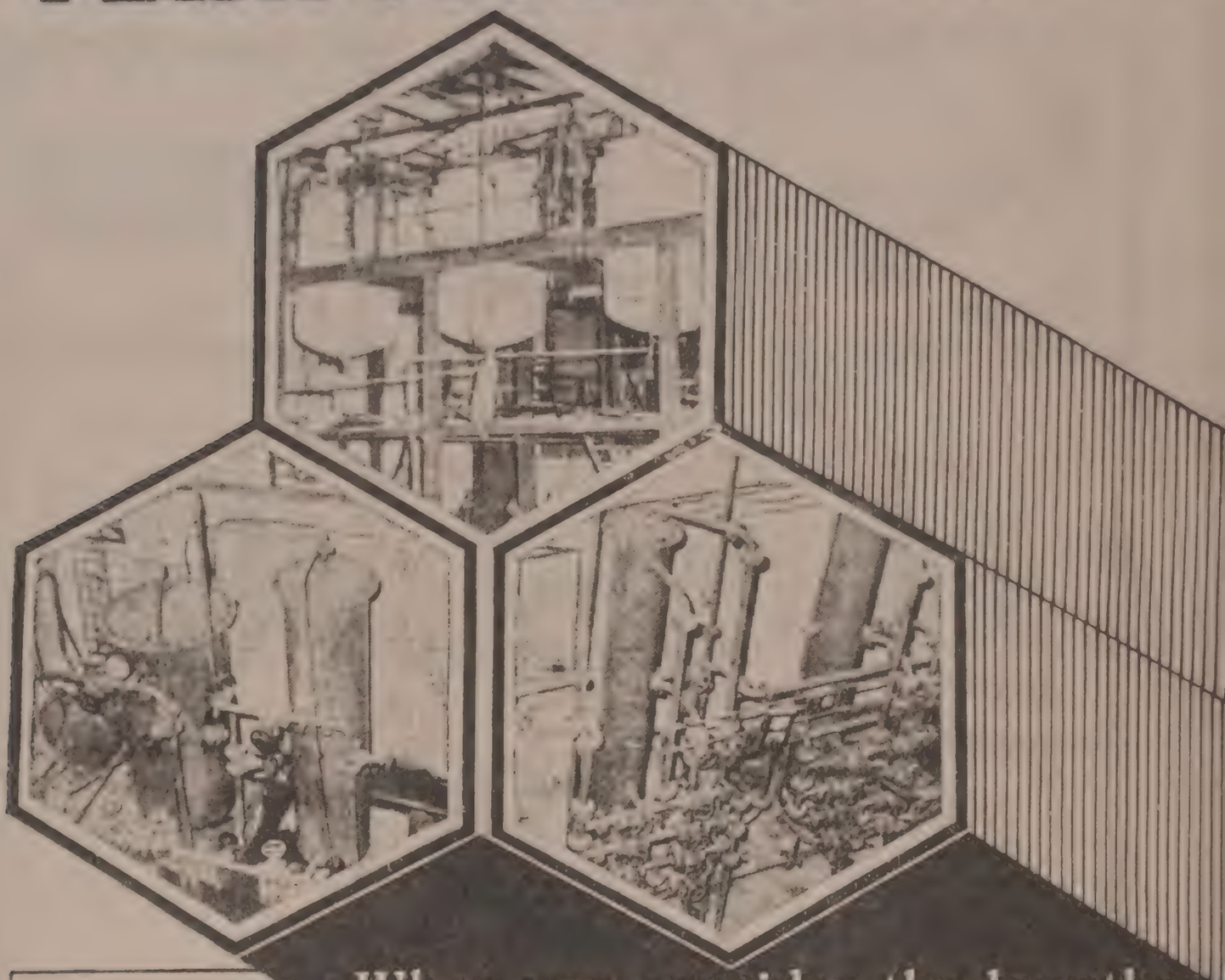

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CHEMICAL WEEKLY

VOL. XXXV SEPTEMBER 19, 1989 NO. 2

HERALDING THE 21st CENTURY - 26 (e)

Changing face of the Planet Earth

In spite of cometary collisions, changes in the sun's energy and upheavals on land, sea and in the atmosphere, Earth has harbored life continuously for roughly 4,000 million years.

Three thousand million years ago: The atmosphere had no oxygen and the sun was 25% dimmer than it is now, but a blanket of atmospheric carbon dioxide (CO_2) nearly 200 times denser than modern levels kept the surface at tropical temperatures. One-cell organisms thrived in the primordial oceans, living off the energy contained in sunlight and sulfurous chemicals from volcanoes and slowly spewing out oxygen as a waste product.

A hundred million years ago: Earth was a hothouse, three to six degrees Celsius warmer than today. There were no icecaps at the poles, and dinosaurs wandered as far north as Greenland. The breaking up of a single giant landmass into smaller continents opened up volcanoes and sea vents that filled the air with CO_2 intensifying the greenhouse effect.

Eighteen thousand years ago: Much of the planet was covered by glaciers, whose cycles of growing and receding appear to be triggered by fluctuations in Earth's orbit and tilt. Average temperatures were about three degrees Celsius cooler than today's, and atmospheric CO_2 was about 60% of modern levels. Ice reached as far south as New York and Chicago, pushing topsoil before it, and winds scattered the soil to form the U.S. farm belt.

Fifty years from now: Computer simulations of how climates will change because of increased CO_2 suggest Earth will be warmer by one to three degrees Celsius and wetter overall, but with changing rain patterns. Some areas, such as much of the American Midwest, will be hotter and drier while parts of Africa wil be cooler and wetter.

The world's worst ecological disaster made human life possible. Two thousand million years ago, the tiny organisms that dominated Earth's primordial oceans dumped huge amounts of toxic waste into their environment. Eventually it killed them, along with much of the other life on the planet. That deadly substance was oxygen. Using satellites to monitor ocean currents, examining tree rings and fossilized pollen for evidence of past climates and simulating the world's future climate on computers, researchers are beginning to see Earth as a complex, interdependent system, in which oceans, atmosphere and life affect one another and help shape the face of the planet.

Among the new discoveries:

* Plant and animal life have saved Earth from a fate similar to Venus's "runaway" greenhouse effect.
* Ocean plankton may play a crucial role in regulating global climate.
* Sudden shifts in currents such as the Gulf Stream can trigger mini ice ages that last for centuries.
* Tiny fluctuations in the Earth's orbit, augmented by changes in the proportions of atmospheric gases, control the advance and retreat of glaciers.

The crucial question that scientists must how answer is how the Earth's machinery will react to the many wrenches that humans have thrown into the works. Man's changes may be small compared with what the Earth has endured so far, but they are coming at an unprecedented pace. Power plants that instantly turn 100-million year old coal deposits into atmospheric gases and bulldozers that plough tropical rain forest into grazing land may not threaten the existence of the planet -- but they could alter the environment for decades or centuries. Even a few degrees change in the average temperature of the planet could make Iowa a desert and the Canadian province of Alberta a breadbasket, and raise sea levels enough to flood Florida and the Caribbean islands. The machinery that interconnects life and Earth includes many gears and levers that act like a governor on an engine, stabilizing and even countering new changes over the long run. Despite bombarments from comets, fluctuations in the amount of sunlight reaching the Earth and the breakup of continents, "the Earth has protected life more than 3,000 million years".

"God has designed this system that runs perfectly", says Wallace Broecker, an oceanographer at Columbia University's Lamont Doherty Geological Observatory. "But God didn't give us a blue print". The degree of complexity that scientists have so far discovered, dwarfs what was imagined even a decade ago, Plankton in the sea exhale chemicals that affect the formation of clouds. Ocean currents such as the Gulf Stream act as a conveyor belt, transporting heat around the world and settling climate patterns that last for centuries at a stretch. Hundreds of separate chemical reactions that take place in the high reaches of the atmosphere control the rate at which man-made chemicals known as chlorofluorocarbons chew apart. Carbon is the backbone of biological chemistry, the stuff of rock and, in the form of carbon dioxide, part of the chemical blanket in the atmosphere that keeps the Earth warm.

In a cycle that takes millions of years, carbon is shifted through a series of elaborate feedback loops to counter forces of change that may arise on the planet. For example, an increase in the amount of carbon going into the atmosphere from an outburst of volcanic activity or the burning of fossil fuel will set off a series of compensating changes throghout the cycle, eventually triggering an

increase in the rate that carbon is pulled out of the air, dissolved in the ocean and turned to rock on the ocean's floor. Through this cycle, the Earth's carbon-dioxide blanket is regulated so that it keeps the Earth within a temperature range that is hospitable to life. Without any carbon-dioxide blanket, the Earth would be on an average 11°Celsius colder than it is today. Without a mechanism to prevent the blanket from growing, the Earth might share the fate of its neighbouring plant Venus, whose carbondioxide laden atmosphere has created a permanent greenhouse effect, heating its surface to 450° Celsius.

Some of the Earth's self-correcting systems can respond very quckly. The chemical process by which the oceans exchange carbon dioxide with the atmosphere works almost instantly and to date has absorbed nearly half the carbon released by human activity. Other carbon-absorbing processes, however, work on a time scale that is, to put it mildly, irrelevant to most of our lives. "Putting carbon dioxide into rocks is a process that takes place over millions and millions of years," says James McCarthy, a Harvard University atmospheric chemist. Humans, he notes, are "reversing that process in a single century". Long before humans got into the business of altering the carbondioxide content of the atmosphere, nature was doing it alone as its self-correcting cycles swung the Earth back and forth between hot and cold periods.

During the dinosaur era 100 million years ago, widespread volcanic eruptions flooded the atmosphere with carbon dioxide, raising the concentration of the gas to a level estimated to be four to ten times higher than today's. The Earth was on average 5° Celsius warmer, alligators roamed around what is now Greenland, and there were no polar ice caps. By the time of the last Ice Age, 18,000 years ago, atmospheric carbon dioxide had dropped to almost 60% of its present level, ice covered much of North America, and what is now Boston was under a 1.6 kilometer-thick glacier. One intriguing clue that has recently come to light hints that oceans may be the real force behind long-term climate change. The chain of evidence begins with a seemingly unrelated discovery; the ten glacial advances and retreats that have occured over the past million years coincided precisely with tiny variations in the Earth's orbit, and thus tiny variations in the amount of sunlight reaching the Earth. That in itself can't explain a major climatic change. But if several new theories are right, oceans may act both to exaggerate small variations in incoming sunlight at first and then dampen the resulting climatic changes in the long run.

Covering some 70% of the planet, the oceans act as a gigantic flywheel in the Earth's machinery. Because of their enormous mass and heat capacity, they warm up and cool down far slower than land masses. And as a huge reservoir of carbon, the oceans can exert enormous leverage on the atmospheric carbon dioxide level -- and thus global climate. One mechanism by which oceans could raise or lower the carbon dioxide content of the atmosphere involves the life within the oceans. Plankton and other marine organisms absorb carbon dioxide during photosynthesis to make food for themselves. When these organisms die, they sink to the ocean bottom and become part of sedimentary rock, thus entombing their carbon dioxide for millions of years. The increased nutrients spawn a population explosion among plankton, which increases the rate at which carbon dioxide is removed from the water. The drop in oceanic carbon dioxide then pulls additional carbon dioxide out of the atmosphere, cooling the Earth.

Ocean currents may also play a major role in setting long-term climate patterns. The evidence for this comes from 12,000-year-old fossils, which show that even as the glaciers were receding from Europe the continent was suddenly and inexplicably thrown into a 700-year long cold snap. Columbia University's Broecker suggests that the solution to this prehistoric mystery centers on the Gulf Stream, the warm Atlantic current that normally gives Europe mild weather. The Gulf Stream is part of a huge oceanic "conveyor belt" current, containing 20 times as much water as all the world's rivers, that carries heat from the Atlantic to the Pacific and from pole to equator. As the water in the North Atlantic surrenders its heat, it cools and becomes more dense and sinks toward the ocean bottom. There it begins a journey along the seafloor back toward the equator, passes around Africa and wells up in the northern Pacific where it flows at the surface toward the equator and around to the Atlantic again. The occurrence of such a large-scale disruption of ocean currents is still speculative, but there is a well-known, smaller-scale current switch called El Nino. This rogue current periodically appears off the coast of Peru, spreading warm water that ruins the fishing season as far north as Washington State and costs commercial fishermen thousands of millions of dollars. It is also thought to cause weather disturbances around the world, from global warming to monsoons in Tahiti, to drought in Africa and Australia.

These lessons of past climatic change are being factored into computer simulations that are now attempting to predict the climate of the next few decades and centuries. Thanks to faster supercomputers and data on everything from ocean temperatures to atmospheric chemicals, these simulations have come a long way since the 1970s, when they were only capable of modelling a globe represented by a single continent and ocean. But computer models are still primitive when compared with the real thing. Scientists are never sure that they have included all the factors that influence a particular part of the system. Several years ago, researchers in Antarctica discovered a gaping hole above the continent, in the layer of ozone in the upper stratosphere that helps filter out ultraviolet light from the sun. Computer models simulating how chlorofluorocarbons might thin out the ozone layer had predicted no such hole. What they had neglected to factor was the influence of tiny crystals of ice floating in the upper atmosphere that serve as a meeting ground for ozone and the ozone destroyers. When this new chemical pathway was subsequently put into the computer model the Antarctic ozone hole popped out. A major effort is now under way to pin down the uncertainties that have so far confounded pedictions and zero in on several nagging mysteries that the Earth has so far stubbornly refused to give up. One is accounting for about 1,000 million tons of carbon that appear to be missing from the carbon cycle.

Another mystery lies in tracking down the source of methane and nitrous oxide, two greenhouse gases far more potent in their climatic effects than is carbon dioxide. Though their total amount is small, they are increasing, and soon their combined effect may surpass that of carbon dioxide. The primary culprits may be bacteria, which release the gases in the natural process of breaking down organic materials in the soil and in the guts of termites and cattle. But scientists suspect that human endeavours contribute, too, because such bacteria also work in flooded rice paddies and landfills, and nitrous oxide is freed by the breakdown of fertilizers and burning coal and gasoline.

Finally, there is the enormous task of putting all the puzzle pieces of land, sea, air and life together into a coherent picture that reveals how the Earth, despite all the shocks it has absorbed over the eons, has been capable of steadfastly harboring living creatures for nearly all of its existence -- and what humans can do to make sure it will continue to do so. But the question for present generations is: Can we learn about the effects of our activities faster than those effects arise? To put it in historical terms, will humans prove to be wiser than bacteria that lived in the oceans 2,000 millions years ago?

-- T.P.S. RAJAN

(Condensed from an article in the *SPAN* February 1989 entitled "Planet Earth — How it works and how to fix it" by William F. Allman of U.S. News & World Report)

CHEMARENA

S.L. VENKITESWARAN

Superconductivity sparks Cooperative Research

Superconductivity at higher temperatures and the promise which it portends has resulted in something totally alien to U.S. -- Cooperative R & D programmes between universities, industrial units and Government national laboratories. Even the biggest in the country like DuPont, A.T. & T, IBM are in line for tie-ups between others or themselves and not going for R&D invididually for the development of practical innovative designs and devices for commercual uses. Obviusly USA is inspired by the organisation of such cooperative efforts in Japan which could confer advantages to that country and cut into the timeframe for success. There is a Council on Superconductivity for American Competiiveness -- CSAC -- a non profit educational association concerned with U.S. competitiveness in emerging technologies in this area. Presently there are consortia between (1) DuPont, Hewlett Packard and Los Alamos National Laboratory; (2) I.B.M., A.T. & T. and M.I.T; (3) University of Houston, University of New York and Lehigh University; (4) Science & Technology Centre of the N.S.F. focussing on applications with pilot centres at different locations. Also in the offing is a Superchip Corporation that would use government loan guarantees to develop, manufature and market superconductor-based electronic appliances. Antitrust and regulatory barriers have been relaxed to enable the major partners to form such consortia.

We are still in the region of about 94°K as the highest temperatures at which superconductivity manifests itself in the special composite materials and a lot has to be done before this unique property gets translated into applications such as highspeed electronics, levitated high speed transportation, medical diagnostics, and electrical generation, storage and transmission. Japanese have two on-going programmes through R & D consortia and U.S. is anxious not to be caught napping through prior Patents from Japanese. One programme in Japan is the ISTEC -- International Superconducting Technology Centre -- for doing materials research, materials characterisation and work on devices. The second programme is by a consortium of six Japanese companies on a 10 year project for superconducting electronic devices financed by the Agency for Industrial Science & Technology. ISTEC consortium is open to companies who pay a hefty fee and provide at least two scientists. Some of the subsidiaries of U.S. companies such as DuPont Japan, IBM Japan, Rockwell International are Associate Members of ISTEC.

The US started off in 1987 on the superconductivity trail with a President level conference and a 11-point initiative that favoured greater cooperation between Government, academicia and industry. A group of "wise men" or committee to advise the President on High Temperature Superconductivity was formed and empowered to recommend various steps in this direction for a five year action plan. The DCAC referred to earlier had its conference recently in Washington DC to review progress. The DuPont led consortium focusses on thin film high temperature superconductors for electronic components. Instrumentation of all types are expected to be revolutionised through these efforts. The IBM/AT&T/MIT group is to attempt development of high speed microelectronic devices for use in computers, communications and military systems. The Center for Superconductivity at Houston focusses on commercialising products through licensing agreements. The Centre's New York station will focus on synthesis, characterisation and processing of new ceramic superconductors. At Lehigh University, the effort is on preparing processing and fabricatiing superconductive ceramics. An intimate linkage between universities and industries will develop and may be the harbinger of such future efforts on other complex areas.

Another consortium proposal that is taking shape is for a Superchip Corporation. This will develop prototypes and then moving them to the manufacturing stage. Here again companies are getting lined up, who will contribute membership fees. But the final objective is to get loan guarantees from the Government to enable manufacturing facilities to be established with loans thus secured. Further on is the Defense Advanced Projects Research Agency which also provides funds for R & D on limited range of superconductivity devices with defence apolications. The various centres also negotiate and enter into agreements with selected parties for specific work on mutually accepted terms.

The massive and unique efforts initiated at the highest levels for cooperative R & D are expected to yield quick results. *(Ref. C.E. News)*

Aniline to Acetaminophen by Bio-conversion?

The process for paracetamol or acetaminophen (APAP) is generally from phenol by nitrosation and then reduction to the paraaminophenol which is then acetylated. The nitrosation is with nitrous acid, but phenol can be nitrated to the nitrophenol which can also be reduced by hydrogen. Nitrosation gives the para isomer while nitration leads to para and ortho isomers which need separation and extra hydrogen is required for reduction of the nitrogroup as compared with nitroso group. The choice of the process depends on particular conditions.

Genex, one of the major biotechnology firms proposes a bio conversion route to make para amino phenol the basic intermediate and for further acetylation . But there is no scaleup for commerical production as yet. They claim high efficiences of conversion — Aniline to APAP of 90.25% and acetic acid (no need for anhydride) of 95%. The microbe is first grown in fermenters and then feed of aniline and acetic acid are maintained over a 7 day cycle in 200,000 litre fermenters. The aniline in the fermenting broth is maintained at 2.28 lb/US gallon while acetic acid is at 1.39 lb/US gallon. This results in a concentration of 3.34 lbs per gallon in the final stage before the broth is sent for recovery of APAP. The recovery is 90%. For the growth of the microbe a medium of fish meal (1.5%), glucose (1.5%), bard oil (2.5%) and nutrient salts are used. The recovery is said to be tricky due to the residual materials but filter aids and chemicals are used to assist in purification of final product. Alternatively, the microbe cells can be recovered after growth and immobilised for use in a continuous conversion reactor but this has not succeeded.

The special strain of the microbe is not disclosed but the process is only shown to be of great potential but requiring a five year effort for scaleup to commercial stage. The tentative estimate for a plant for 100 batches over a 7 day cycle with two 50,000 gallon fermenters, each batch of 100,000 pounds of APAP (10 million pounds a year) is $7.8 million for equipments and about 15-20 million $ for the whole plant including development costs. The estimate of cost of manufacture is 61 cents a pound with overall costs including depreciation and interest at $1.05 per pound. Steam and electric power requirements are substantial.

The price of APAP (paracetamol) is said to have touched Rs.150 per kilo equal to over $4 per pound. The cost of aniline in India is extremely high as against a dollar per kilo in USA, but even so the economics look attractive for a bio conversion route to APAP. Some effort could be initiated in R & D for this product and process.

Some disturbing aberrations

We had commented in these columns on the attempts to resuscitate and give a new life to old plants. This was with particular reference to the polyethylene plant (high pressure, low density process) at Rishra in West Bengal with a capacity of 12,000 tonnes. The inspiration was perhaps the easy entry to a lucrative sellers' market supported by a high customs duty on imports. Years of struggle for getting alcohol as a feedstock for this plant from distant U.P. or Tamil Nadu or through imports ended only in frustration and closure of the plant. Shifting and re-erection in U.P itself, the centre of surplus alcohol, of this outdated plant by the new entrepreneur was not permitted by the West Bengal Government — their objection was irrational — left the purchaser of this plant with the only option of running it there itself and the restart was enthusiastic about the promised supply of alcohol from U.P. But this optimism was shortlived and the alcohol has been available only to a limited extent and has now dried up leading to closure of the plant with little prospect of any restart. Now comes the idea of shifting ethylene from the old small cracker of their associate company which is located in Bombay — also a shutdown plant taken over after extended negotiation with the Government of Maharashtra. But this naphtha cracker of about 20,000 tonnes of ethylene is linked to its own LDPE plant and certainly with no ethylene to spare if the LDPE plant in Maharashtra is to be operated. One cannot envisage the Govt of Maharashtra to agree to such an arrangement.There is also a reported condition that expansions will not be permitted in the area and that the old plants are to be operated as such with the full complement of the labour who have been idling there for over 2 years. This crazy alternative is unlikely to get through and then are we going to import ethylene for this small plant and if so at what cost?

We have some other cases of closure of plants located at centres with no alcohol availability and dependence on distant suppliers. Fortunately there are no knights to take over such plants as that of Sirsilk.

It is a pity that India has to face problems of this type in spite of its planned economy and Regulations for Industrial Development. At the other end we have approvals of new multicrore projects in the field of petrochemicals without any thought to the financial resources situation for the 8th Plan — more about these later.

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Notices served on producers of paracetamol

Manufacturers of paracetamol have been served with notices asking them to deposit to the drug price equalisation account (DPEA) the amounts they have been charging above the notified price. Paracetamol is a price controlled bulk drug falling in category 2 of the Drug Prices Control Order (DPCO).

The industry has been ailing for quite some time due to acute shortage of p-nitrochlorobenzene (PNCB), the main input. This has led to the closure of some units and consequent shortage of the bulk drug. Paracetamol bulk price has shot up to Rs. 170 per kg. and may hit the Rs. 200-mark if the shortage continues, it is feared.

Leading producers like Dinesh, AP Chemicals and Sri Krishna have all received notices for charging more than the official price of around Rs. 115 per kg. Producers say prices of major inputs and utilities have sharply risen in recent months, making the official price unrealistic.

PNCB price has gone up to Rs. 33 per kg. and the open market prices are much higher. Caustic soda price has shot up from Rs. 6,500 to Rs. 11,000 a tonne. Acetic anhydride, another raw material has gone up from Rs. 22 to Rs. 26 per kg. The cost of utilities like power have also been pegged down in most States. Paracetamol is reserved for the small sector and most units are single product outfits not enjoying the leeway that bigger pharmaceutical units enjoy.

What is anomalous in the current situation is that while producers have been threatened with action, traders are not being pulled up for the same offence. Producers, under the circumstances, can circumvent the official fiat by opening trading front companies to whom they can sell at the notified price.

Prices fixed by the Bureau of Industrial Costs and Prices (BICP) are violated in the case of several other products, with the connivance of the State Governments. For example, industrial alcohol is sold at higher than the BICP-fixed price of Rs. 2.26 a litre in all States except Uttar Pradesh. No action has been taken to eliminate the practice despite protests.

GFCL PLANS TO SET UP PHOSPHORIC ACID PLANT

The Godavari Fertilisers and Chemicals Ltd. (GFCL), the only diammonium phosphate (DAP) manufacaturer in Andhra Pradesh, is studying the viability of setting up a captive phosphoric acid plant to overcome the shortage of this vital input which has crippled production at its Kakinada plant.

The project may be set up either in West Asia where assured supplies of raw materials were available or in a coastal location in India, said Managing Director, M. Gopalakrishna. "We are working seriously on this project to meet at least 50% of our requirements," he said. GFCL requires about three lakh tonnes.

The overseas locations under study are Iran, Jordan, Tunisia and the U.A.E., countries which offer ready availability of either rock phosphate or sulphur. Apart from the raw material consideration, an overseas location would also help cut capital costs by around 30% for the project which would require an outlay of Rs. 140 crores to Rs. 150 crores.

The shortage of phosphoric acid has severely affected the working of GFCL's Kakinada plant where production was halted for five months. Mr. Gopalakrishna said, that the plant was now working at full capacity following resumption of imports by the Government of India.

However, the sharp price fluctuation in the international market had left DAP manufacturers prey to uncertain supplies and the GFCL was therefore working on a project to have a captive plant for the manufacture of phosphoric acid.

The company was also thinking in terms of manufacturing or importing zinc sulphate, an important micro nutrient which was in short supply, added the MD.

"A deficiency of 100 grams of zinc sulphate can render about 100 kg. of urea ineffective and it is vital therefore that adequate supplies are ensured," he said.

Although production is now reserved for the small-scale sector the Government was keen to increase availability by 25% and GFCL was considering the manufacture of zinc sulphate to overcome the shortfall.

SMALL LEATHER UNITS RESENT DUTY HIKE ON METALLIC ITEMS

The Small Scale Leather Industries Federation has resented the recent hikes in basic duty on metallic embellishments such as hooks, magnetic locks, clips, etc. which have been increased from 40% to 187%.

Mr. Prakash H. Mathani, president of Small Scale Leather Industries Federation, in a press note, said the hikes would adversely affect the production and ultimately exports of leather products.

He also added if hikes were not withdrawn many small leather units would close down rendering hundreds unemployed. While he hailed the Govemment policy of liberalisation and steps taken to boost exports, he felt, the hikes in duty was a retrograde step and was curbing exports of value-added products from India.

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FALL-OUT OF PRICE CUTS:

Manufacture of vital drugs stops

Burroughs Wellcome, the first private sector drug company in the country to make Dapsone, the widely used anti-leprosy drug, has discontinued its production since last December.

Glaxo India, one of the manufacturers of Ibuprofen, an anti-inflammatory drug, has stopped its production since last four months. A number of small drug units manufacturing Rifampicin, an advanced anti-TB drug, have also shut down their plants a few months ago.

The reason for stopping the production of these essential drugs by the drug companies is stated to be the uneconomic prices fixed by the Government under the Drug Price Control Order of October, 1987.

A spokesman of Burroughs Wellcome said that the price of Rs. 259 per kg fixed by the Government for Dapsone was too low. The production of the drug cannot be viable at that price, he pointed out. The company had thus, no option but to stop the production of the drug. As a result the Government is still importing the drug through the State Trading Corporation although four drug companies, including Burroughs Wellcome, are licensed to manufacture the drug.

In the case of Ibuprofen, the Government had abruptly cut its price to Rs. 400 per kg. from Rs. 810 per kg. in January this year. The price cut was termed as arbitrary and unrealistic by industry circles. A senior official of Glaxo made it clear that the company was not going to restart Ibuprofen production although the Government had subsequently revised the price of the drug on the basis of the recommedations of the Bureau of Industrial Costs and Prices.

The Government effected a similar cut on the price of Rifampicin in January last without considering the actual costs of production, industry sources pointed out. The price of the drug was reduced to Rs. 2,500 per kg from Rs. 3,000 per kg.

The price cut came at a time when the drug units were seeking an upward revision of the price of Rifampicin. Quite a few drug units have thus, suspended production. The Government had, however, revised the price to Rs. 3,409 per kg later.

Industry sources pointed out that although DPCO, 1987, aimed at a remunerative pricing for drugs, many of the drug units are still caught between arbitrary price fixation on the one hand and escalating costs on the other.

BOPP FILM MAY USHER IN PACKAGING REVOLUTION

The food processing industry is poised to take a quantum jump in the coming decade, as is evidenced by the creation of a separate Union Ministry for Food Processing Industries. Biaxially oriented polypropylene film (BOPP), an attractive and versatile packaging material, will play an important part by meeting the sophisticated packaging needs of a wide variety of processed foods such as confectionery, biscuits, spices, snacks, etc. Its excellent barrier properties, both in relation to gaseous and moisture ingress, mechanical strength and aesthetic appeal, help meet the international standards of packaging, giving it a special place in India's export efforts.

The usage of this film in India today is only around 6,000 tonnes per annum, whereas a small country like South Korea uses as much as 50,000 tonnes per annum and even a developing country like Indonesia is currently using 20,000 tonnes per annum.

The energy saving potential of BOPP is worthy of note. It is an economical packaging substitute for energy-intensive and expensive aluminium foil. It may be mentioned that one tonne of BOPP film can save 5 tonnes of valuable timber by replacing paper in packaging. With the availability of polypropylene improving with Maharashtra Gas Cracker's (MGCC) imminent commissioning, the market for BOPP film will receive a big stimulus.

NOCIL has undertaken substantial market development efforts for BOPP film, including storage life studies, developing films of different constructions to suit various end-uses and improving printability. A well qualified technical team has been at work on BOPP film in close co-ordination with packaging machinery manufacturers, laminators, convertors and consumers. The film, to be manufactured by Mupnar Films Ltd., Indore, will be marketed by NOCIL under the brand name "NOCILAR".

OZONE SHIELD TO BE REPAIRED

A centre for business co-operation with foreign countries has recently been set up in Moscow to establish an international ecological ozone reserve fund. Its two sponsors are the publishing department of the Moscow Patriarchate and the Inter-Branch "Noosphere" Engineering Association.

Experts have calculated that in the past 16 years, the ozone content in some parts of the world has declined by an average of three and every percentage point drop in the ozone layer increases the number of skin cancer cases by five to seven.

The centre will start with introducing ozone generating substances into the ozonesphere at an altitude of 22 to 24 km. The experiment will involve several ministries and departments.

Penicillin-G allocation policy unproductive

The Government's allocation policy for penicillin G appears to have failed. Several drug units making 6-APA, a vital drug intermediate, who have to mandatorily lift their penicillin G requirements from Hindustan Antibiotics Limited (HAL), have run out of stocks as HAL is unable to meet their full quota requirements.

These drug units, at the same time, cannot lift penicillin G from the Indian Drugs and Pharmaceuticals Limited (IDPL), although it is available in plenty with this Government undertaking. This is a direct fallout of the Government policy which specifies that drug units operating in the western region should lift their penicillin G requirements from HAL and all other units should lift their local requirements from IDPL. The units, thus, do not have the option to choose between the companies.

Moreover, drug units have a preference for penicillin G made by HAL because of its superior quality, industry sources point out. Even some of the units which are required to do so are not lifting the drug from IDPL.

The sources further say that some of the affected units are ready to lift penicillin G from IDPL, thereby sacrificing quality. But under the policy, these units cannot get allocation from IDPL. In addition, if they do not lift 30% of their requirement from HAL, they will not get the licence to import the remaining amount of penicillin G needed, as under the allocation policy drug units should lift 30% of their requirements from HAL or IDPL in order to get import licences.

This anomaly in the allocation policy has, in fact, affected the production of some of the 6-APA units. Penicillin G is required for the manufacture of two vital drug intermediates namely 6-APA and 7-ADCA. The current demand for penicillin G is placed at about 1,400 mmu (million megawatt unit). Against this, domestic availability of penicillion G to the units making 6-APA and 7-ADCA is only around 400 mmu. The rest of the requirement is being met by imports.

The demand for penicillin G has been growing at the rate of 25 to 30% for the last three years. Industry's estimate is that the total demand for penicillin G would be in the region of 3,500 mmu by 1995. Meanwhile, prices of Ampicillin and Amoxycillin, two widely used antibiotics made from 6-APA, continue to fall in the market because of excess availability. The price of Ampicillin is stated to be around Rs. 15.50 a kg in the market now against the Government fixed price of Rs. 18.50. In the case of Amoxycillin, the market price is Rs. 17.50 a kg as against the Government fixed price of Rs. 28 a kg.

With the fall in the prices of Ampicillin and Amoxycillin and the resultant unviability, some drug units have already stopped production of both the antibiotics.

LASER TO GUARD OCEANS

The General Physics Institue of Soviet Academy of Sciences and the Kolomenskoye Centre of Young Engineers have designed a laser which can detect an oil spill in the ocean. It can determine the area, depth and time of the pollution in several minutes and do a precise chemical analysis of the pollutant.

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BULK DRUGS PRICING:

Simpler rules likely

The Union Government is considering simplifying the procedures relating to pricing of bulk drugs and their formulations. This will be done within the Drug Price Control Order (DPCO), 1987.

An indication to this effect was given at New Delhi, on September 6, by Mr. M.S. Gill, Secretary, Department of Chemicals and Petrochemicals. He told newsmen that a decision on the simplification formula would be taken soon. At present, he said, the Government fixes prices of every product. "There are other ways of doing it. We are exmining this issue."

He said the DPCO had reduced the spread of price controls to 124 from 364 drugs. Of this, the prices of 63 drugs had been fixed. "We have another six in the pipeline to be fixed by the BICP." According to Mr. Gill, the Government was also examining possibilities of giving futher incentives for research and development to the drug industry. The drug companies, he said must be encouraged to go in for research of formulations as well.

Referring to export of drugs, the secretary said that many companies here had just finalised contracts with the Soviet Union for shipping drugs and pharmaceuticals that could be worth Rs. 175 crores. This followed the visit of a large Soviet delegation to India recently.

Mr. Gill said the Soviet administration had just released an additional 500 million roubles for purchase of medicines to meet the shortfall in that country. Approximately 20% of this amount was likely to be spent on imports from India. The Soviet delegation, he said, had discussions with leading pharmaceutical companies like Unichem, Lupin, Themis Chemicals, German Remedies, Hoechst, Armour Chemicals, May and Baker, Cadila and J.B. Chemicals.

The petrochemicals secretary explained that the Rs. 175 crore order would give a major fillip to the drug industry in India. Of the total exports of Rs. 468 crores last year, shipments to the Soviet Union alone stood at Rs. 100 crores. In addition, the Soviets are planning to set up four factories for making insulin, vitamins, antibiotics and synthetic drugs on a turn key basis. For this, about 400 million roubles had been earmarked. The Soviet unit was now in the process of shortlisting suitable Indian companies which could bid for these joint ventures.

Regarding the pharmaceutical industry in the country, Mr. Gill, said that its production during 1988-89 was placed around Rs. 3,700 crores. The Eighth Plan envisaged the figure should touch the Rs. 10,000 crore mark. About drug prices, the secretary felt that even in decontrolled items, the prices had been pegged low. We should look at the industry which had tremendous potential for export and domestic growth. The DPCO could not be taken as the sole mechanism for controlling prices.

Incidentally, 30% of the drug production in the country was accounted for by the small scale sector. Out of the total production, as much as 80% was contributed by Indian companies and the balance by MNCs.

SUDARSHAN CHEMICAL

Sudarshan Chemical Industries has fared well during the six months period ended June 1989. Net sales amounted to Rs. 32.38 crores against Rs. 22.88 crores and earned a gross profit of Rs. 340.90 lakhs against Rs. 217.02 lakhs.

After depreiciation (Rs. 170 lakhs against Rs. 138.10 lakhs) and taxation (Rs. 15 lakhs against Rs. 23 lakhs), the net profit amounted to Rs. 155.90 lakhs against Rs. 55.92 lakhs.

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Russia offers to set up high pressure polyethylene project

The Soviet Union proposes to set up a three billion rouble high pressure polyethylene project in India in the joint sector, said Mr. I.E. Khotsialov, co-chairman, Indo-USSR working group in developing new forms of co-operation with India. In a tete-a-tete with a UNI correspondent, Mr. Khotsialov said the feasibility report for the proposed joint venture was expected to be ready by November. The preliminary report for the setting up of the project was quite encouraging since the raw material was available aplenty in India from her refineries.

The project would save India from a large amount of hard currency which she presently had to shell out on importing the technology and manufacture of high pressure polyethylene. It would make the country not only self-sufficient but also open up great vistas for setting up several industries based on the item, he said. Agreements had been concluded for five joint projects to be set up by the Soviet Union in India including the high pressure polyethylene project. The four other joint ventures approved by the Indian Government included transport and licensing, he said.

Mr. Khotsialov, who is heading a three-member high-level delegation currently on a tour to India to explore the possibilities of mutual joint ventures in both countries, said likewise the Soviet Union Government had approved 14 joint venture projects to be set up with Indian collaboration. There was great potential for setting up joint ventures by India in Russia in the areas of hotel complexes, restaurants, leather industry, electronics, computers and consumer products based on locally available raw materials. If the opportunities and possibilities were earnestly tapped, "great results" could be obtained, he said.

Mr. Khotsialov also said more than 50 joint venture proposals were under different stages of discussions between the Governments and industry of both countries. The Soviet Union had recently opened up a credit line from its bank for joint ventures in the country, he said. It expected India to take reciprocal measures by making available credit to its private entrepreneurs from banks and other Government financial institutions.

This would give a fillip to joint venture collaborations between the two countries, he said, adding that there was also possibility of mutual collaboration in transfer of technology between the Soviet Union and India in the areas where both need them "badly". Earlier, speaking at a meeting organised by the confederation of engineering industry (CEI) on developing new forms of economic co-operation, while referring to a point made by CEI Chairman J.N. Godrej, Mr. Khotsialov said the issue of repatriation of rouble profits was "not a great problem at all" and would be mutually overcome soon.

Mr. Godrej said presently the rouble profits could only be utilised in the USSR particularly for reinvestment in joint ventures. The rouble repatriation problem must be overcome to facilitate development of joint ventures with Indian collaboration, he said. Free Foreign exchange component in the setting up of joint ventures in India, was provided by the Indian authorities under the Indian policies and laws, Mr. Godrej said adding that the USSR should also provide free foreign exchange necessary for setting up joint ventures in the USSR so that this constraint was removed.

Mr. Khotsialov wanted the Indian Government to relax its rules and regulations with regard to joint venture collaboration. He also emphasized the need for setting up Indian Trade Centres in the Soviet Union and said the Soviet Government was actively considering the same for India. By the end of this month the Soviet Government would make available in India a book for entrepreneurs which would serve as a guide for setting up joint-ventures in the Soviet Union, he said. The book would be updated every three months, he added.

The Soviet delegation is touring India to collect data for the second meeting of the working group on developing new forms of economic co-operation within the framework of the inter-governmental Indo-Soviet commission on economic, scientific and technical co-operation. The first meeting was held in Moscow between June 21-26. The Indian delegation was led by Ms. Otima Boradia, Secretary of the Department of Industrial Development.

15% MAIDEN DIVIDEND FROM RAMA PETROCHEMICALS LIMITED

Rama Petrochemicals Limited which commenced commercial production of methanol from the middle of April 1988, has achieved capacity utilisation of over 100% in the very first year of operation and its turnover during the thirteen months period ended on 30th April 1989, amounted to Rs. 42.71 crores and production and despatches of methanol during the period were 54,700 MTs. and 53,510 MTs. respectively. The company has earned a gross profit before interest and depreciation of Rs. 1,014.85 lacs. The interest charges amounted to Rs. 356.90 lacs and the depreciation provision for the period was Rs. 355.45 lacs. The net profit after interest and depreciation for the period, which is the first year of operation, amounted to Rs. 302.50 lacs and since the company dose not have any tax liability, the profit available for appropriation also amounts to Rs. 302.50 lacs. The Directors have recommended a dividend at the rate of Rs. 1.50 per equity share subject to deduction of tax at source.

RCF sets up methylamines, DMF complex at Thal

Rashtriya Chemicals & Fertilizers Ltd. who pioneered the manufacture of methylamines in India in 1974 are now setting up a new methylamines and dimethyl formamide complex at their Thal Unit with a total investment of about Rs. 23 crores. The foreign exchange element of this investment will be about Rs. 3 crores. Major component of the plant and machinery will be indigenous.

The civil works for the above complex are in an advance stage and procurement of critical equipment has started. Detailed engineering for the plant is being done by PDIL and it is anticipated that the production of both methylamines and dimethyl formamide will commence by May 1991.

The existing methylamines capacity at Trombay Unit of RCF is 4000 MT/annum and the new plant at Thal is designed to produce 5000 MT/annum. Energy saving devices such as use of structured packing in the columns, integrated energy balance and waste heat recovery are being incorporated in the plant. Distributed digital control system (DDC) is envisaged for this plant.

The abundant availability of methylamines will encourage an increase in the production of their derivatives.

The plant capacity of dimethyl formamide (DMF) is 2500 MT/annum which is adequate to meet the requirements of this solvent in India.

The methylamines consisting of mono, di and tri methylamines have multifarious uses. monomethylamine (MMA) is the basic material used in the manufacture of insecticides like dimethoate and monocrotophos. One of the safest and superior quality of slurry explosives utilises monomethylamine nitrate as a sensitizer. Dyestuffs and Intermediates like N-methyl J-acid, sarcosine and monomethyl aminoethanol are also based on MMA.

The highest consumption of dimethyl amine (DMA) is in the manufacture of a selective weedicide "ISOPROTURON" which has revolutionised wheat production in India increasing yields by 20-25%. DMA is also used in the manufacture of fungicides viz. ZIRAM AND THIRAM, the rubber chmeical, TMTD, Solvents like dimethyl formamide and dimethyl acetamide, drugs like trimethoprim and intermediates such as dimethyl aminoethanol which is used in production of ion exchange resins and also antihistaminic drugs. Dimethyl amine also finds use as a modifier in the production of rayon tyre cord and High wet Modulus rayon fibre.

Trimethylamine (TMA) is used in the manufacture of Choline Chloride, a poultry feed additive, ion exchange resins and quaternary ammonium compounds.

Presently, at least 50% of the total methylamines available in India are used in the production of agrochemicals. Consumption of dimethyl amine for the manufacture of solvents is insignificant today.

The new complex of RCF at Thal will captively consume at least 1500 mt of dimethyl amine annually for the production of dimethyl formamide.

Dimethyl formamide is predominantly used in spinning acrylic fibre. The largest users of this solvent are likely to be a Public Sector unit manufacturing acrylic fibre in Gujarat and two more projects in the private sector under implementation in U.P. and H.P. The other uses of dimethyl formamide will be in spinning of Polyurethane fibre and production of polyurethane artifi-

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cial and synthetic leather. This solvent is also used in the country for the production of pharmaceuticals, dyestuffs and pigments. The availability of dimethyl formamide will encourage setting up of more plants for manufacture of acrylic fibre which is a substitute for wool and has a demand in the Northern parts of the country during winter. The addjtional availability of methylamines will also result in increased exports of their derivatives. It is estimated that the country is likely to earn about Rs. 10 crores of foreign exchange through exports of methylamines' derivatives and further save about Rs. 5 crores of foreign exchange in making indigenous dimethyl formamide available in the country.

RCF have been marketing methyl amines in India for the last 15 years and have also started imports of dimethyl formamide for sales to the consumers until the Thal Unit becomes operational. The total turnover of RCF from this new complex is expected to be more than Rs. 22 crores annually.

HIGHEST EVER NET PROFIT OF Rs. 83 CRORES.

PERFORMANCE HIGHLIGHTS

* Production placed at 25.76 lakh tonnes of fertiliser.
* Sales pitched at 31.39 lakh tonnes of fertilizers.
*Sales turnover mounts to Rs.1244 crores - 37.40% increase over the last year.
* Gross Profit swings to Rs. 331 crores before revision, and Rs. 229 crores after revision of retention price.
* Net Profit leapfrogs to Rs. 185 crores before revision and Rs. 83 crores after alteration of the subsidy formula.
* All plants average 100% capacity utilization.
* Servicing of debts and repayment of loans ahead of schedule.
* Modernisation of rehabilitation schemes nearing completion.
* New thrust added to R&D activities.

The financial year 1988-89 marks a new watershed in the history of Rashtriya Chemicals & Fertilizers Ltd. There is upmanship practically on all fronts.

The company is reigning supreme in the fertilizer scenario in the country. It has emerged as the largest producer and seller of fertilizers during 1988-89, edging out all other fertilizer companies both in the public and private sector.

Operating performance during 1988-89.

The year 1988-89 has ended for RCF on an exceptionally good note. The production of fertilizers (Urea and both the complexes) is placed at 25.76% lakh MT, which is 11.37% more as compared to the previous year's production at 23.13 lakh MT. The sales of fertilizers also touches a new high at 31.39 lakh MT compared to 21.1 lakh MT of the previous year, establishing a growth rate of 48.76%. This growth rate has neither been achieved nor equalled by any other fertilizer manufacturer in the country. The value of sales stands at Rs. 1244.07 crores as against Rs. 905.33 crores recorded during 1987-88, giving a growth rate of 37.4%.

The gross profit zoomed to an all time high at Rs. 229 crores. After providing for Rs. 109.58 crores a depreciation and Rs. 36.73 crores as interest, the pre-tax net profit leapfrogs to Rs. 82.94 crores as against Rs. 63.11 crores netted during the previous year. The profit of Rs. 82.94 crores is a record earning never achieved in the annals of fertilizer industry in the Public Sector. The brilliant performance of the company has been possible due to the dedicated workforce of the organisation,

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compounded by a benign monsoon recorded last year. Though RCF was saddled with a carry forward inventory to the tune of 13.94 lakh MT of fertilizers during 1987-88, the efficient marketing management coupled with aggressive strategies adopted by our field staff, resulted in liquidating about 6.5 lakh MT during the period under review.

General health of the Fertilizer Industry.

Due to the imports of fertilizers in the earlier years, the glut conditions continued to exercise unimaginable pressure on the fertilizer industry. With effect from April 1, 1988, the Government of India revised the capacity utilization norms for retention price calculation for various types of feedstocks used in the manufacture of fertilizers. The intention of the Government was to reduce the subsidy burden which is expected to touch Rs. 3000 crores this year. However, the norms adopted now will make fertilizer companies earn lower returns, and this may be a damper in the growth and diversification programmes. Naturally, the revision of the retention price formula made a considerable dent in profitability which is reflected in highlights. With the excellent production and excellent monsoon it was a challenge to sell or offload as much as possible. There was a pent up in demand due to a good wet spell during 1988-89 and consequently, offtake matched with the stocks available with the manufacturers. The situation this year, is also encouraging as we are having good monsoons at the moment. The Government approved 7.5% discount on urea prices also gave tremendous fillip to the fertilizer consumption in the country during 1988-89. The total fertilizer consumption in the country registered a growth rate of 21.6% during the year under review at 11.5 million tonnes, resulting in a record foodgrains production of more than 170 million tonnes.

Production performance at Trombay.

The Trombay Fertilizer plants produced 11.24 lakh tonnes of fertilizers including both urea and the complexes during 1988-89. The Urea-I and V achieved 106% and 105% capacity utilization. The rehabilitated Suphala plant produced Suphala 15:15:15 to the tune of 3,62,820 MT which is 121% of the installed capacity. The ANP (20:20:0) production was placed at 3,10,225 MT. The Trombay Ammonia plant produced 3.63 lakh tonnes of Ammonia during the last year.

The methanol production at 42,035 MT registered a capacity utilization of 117% as against 41,716 produced in the previous year. The new nitric acid plant at Trombay achieved an all time high production record of 2,55,025 MT operating at a capacity utilization of 103%.

Trombay's Industrial Products contributed handsomely in boosting up the profits. Their performance has been superb. The production of ammonium bicarbonate - a vital input in the bakery industry is placed at 5040 MT giving a capacity utilization of 126%. The production of sodium nitrate/nitrite nestled at 5000 MT as against 3926 MT produced last year. The methylamines production was registered at 3307 MT as against 3096 MT achieved last year. The product is a vital input for the manufacture of life saving drugs, leather industry and pesticides.

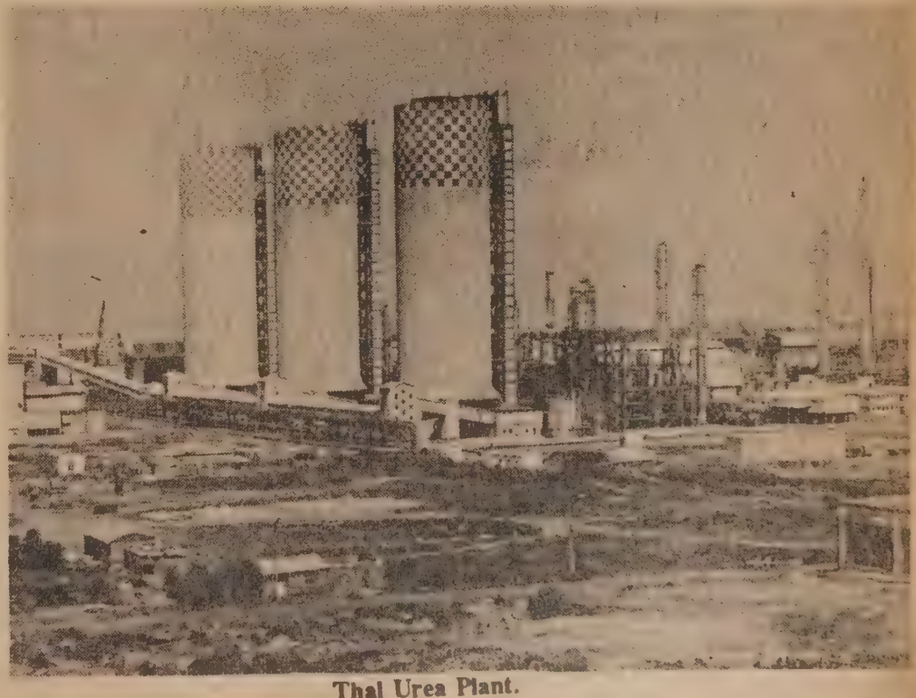
Thal production performance.

The outstanding achievement of th Thal Fertilizer Unit was the highest ev yearly production of ammonia and ure Both the ammonia plants of 135 MTPD capacity registered an all tim high annual production of 8.65 lakh M during 1988-89 as against 7.9 lakh M of last year. This is 9% excess over th last year's production.

The month of December saw a reco production of 80,403 MT of ammon which equals to 108% of the installe capacity. Close on the heels of ammon plants, urea plants also registered th highest ever production at 14.52 lak MT as against 13.3 lakhs MT last yea This is also 9% excess over the la year's production. The highest dai production of 5075 MT was achiev on 18th June, 1988, as against the dai rated capacity of 4500 MT. A reco production of 1,42,260 MT w achieved in the month of January, 198 rating at 113 per cent of the install capacity.

Heavy water plant.

The heavy water plant set up at Th on behalf of the Atomic Energy Co mission, is fully stabilised and is op ating very well as per the targets.



Thal Urea Plant.

Marketing performance:

RCF's Marketing Division takes the cake in performing exceedingly well, selling 31.39 lakh MT of fertilizers during 1988-89 as against 21.10 lakh MT sold during the previous year. This coveted performance puts RCF at the pinnacle of the fertilizer industry. The product wise sales during 1988-89 were 23.92 lakh tonnes of Ujjwala Urea, 3.95 lakh tonnes of Suphala 15:15:15 and 3.52 lakh tonnes of suphala 20:20:0 which are 53%, 38% & 34% more than the sales during the previous respectively.

The spurt in fertilizer demand due to generous monsoons had a soothing impact on the company's inventory levels, a total of which stood at 13.94 lakh tonnes at the of 1987-88 came down to a reasonable level of 7.59 lakh MT at the end of 1988-89, a reduction of 45%.

RCF's Marketing Division has also set up a "Farmers' Training Institute" at Nagpur at a cost of Rs. 70 lakhs in collaboration with the Punjabrao Krishi Vidyapeeth, Nagpur and EEC. The main objective of establishing this institute is to provide scientific training to the small and marginal farmers, particularly from the weaker sections of the society and the woman farm labour. This will also provide a package of modern farm practices developed by the Agriculture University towards quick transfer of technology at the village level.

Industrial products:

The Industrial Products Division of RCF continued to forge full stream ahead and registered a all time high sales turnover of Rs. 73.63 crores, which is 10.5% higher than last year. RCF continues to be the co-ordinating agency for the imports of ammonia for the Indian Fertilizer Industry and handled 6,47,500 MT of ammonia during the year, registering an increase of 36% over the last year. The number of ports handled increased to nine and the number of consortium members rose to 12. During the year, one of the ammonia vessels loaded from Saudi Arabia was hit by enemy gunboats and part of the cargo was lost and vessel immobilised and declared unfit for completion of voyage. By chartering another vessel, ship to ship transfer was successfully organised to salvage the balance cargo. This is a very rare operation in such hazardous chemicals trade.

The Division assisted export of Methylamine based products i.e. isoproturon, di-methyl hydrochloride and dimethylamine salt of Dacamba to USA, USSR, South East Asia and West Asia. Methylamines based products exported in the year amounted to Rs. 6.6 crores.

Research & Development:

RCF's R&D activities continued to gain momentum during the year. An ammonium polyphosphate pilot plant having a capacity of 12 MT per day has been commissioned. The plant has already achieved a capacity utilization of 600 kg/hr. The plant is being operated to collect scale-up data on pollution control measures etc. A preliminary design for a 300 MT/day plant is expected to be ready by the end of 1989.

A Bio-fertilizer laboratory has been set up for research in plant tissue culture and bio-fertilizers. Work is on hand on superior varieties of sugarcane and medicinal plants.

RCF has also set up a bench-scale facility for urea nitric phosphate. This is a new product which fixed the P_2O_5 as a complex to calcium nitrate and urea in water soluble form without the use of sulphuric acid.

A mini reactor has been installed in the methylamines plant for testing the zeolite catalyst developed in collaboration with the National Chemical Laboratory which has shown encouraging results in optimising methylamines production in the laboratory. On the basis of the pot culture studies, field trials are in progress to evaluate the nitrogen inhibition properties of the neem extract coated urea.

Studies on the structure determination of the active constitutent of the neem extract used as a nitrification inhibitor are in progress.

Rehabilitation & Modern schemes:

RCF's ambitious programme to modernise/rehabilitate the ageing plants by proper retrofitting in order to revitalise them and keep them in the fittest and most efficient conditions, has made considerable headway. The main focus while modernising the plants in on upgradation of technology, conservation of energy, improvement of environment and optimisation of production capacity. After successfully carrying out the NOX abatement scheme in the old nitric Acid plant and rehabilitation of the Suphala plant, it has in hand the rehabilitation of Ammonia-I plant. The front end of this 23 year old plant is being modernised by changing the process from partial oxidation to steam reforming. The estimated capital cost of the project is about Rs. 66 crores with a foreign exchange component of Rs. 6 crores. The entire investment will be paid back in a period of 4.36 years. The project is in advanced stage of implementation and is scheduled to be commissioned by April, 1990.

The Urea-I plant is being modernised by adopting the latest technology, at a capital cost of Rs. 6 crores with a foreign exchange component of Rs. 66 lakhs. This will reduce pollution by recovering about 6 Tonnnes/day of ammonia with less gaseous emission and leakage of ammonia; reduce steam consumption and there would be a substantial improvement in the quality of the product. The project has been completed and is under commissioning which will be over within a month. The Methanol project modernisation envisages reduction in energy consumption by 30%, optimisation of the plant

capacity, and reduction in maintenance cost.

Diversification schemes/new projects:

RCF's ambitious programme to expand and also diversify in other areas to increase profitability has made much headway. The company had received offers from the Government of Madhya Pradesh and Hindustan Zinc, Rajasthan, to put up plants for the manufacture of phosphoric acid and phosphatic fertilizers based on the raw material existing in the States. The Techno Economic Feasibility Reports are being prepared. The approximate cost of these projects will be Rs. 600 crores.

Industrial chemicals - methanol:

The Government of Tripura has invited RCF to plan and implement one lakh MT per annum methanol plant using natural gas, as a joint venture with Tripura Industrial Development Corporation, ONGC and IBP. The TEFR for the project has already been made and detailed project report is almost complete. The estimated cost of the project is Rs. 115 crores, of which Rs. 40 crores will be equity which will be shared by the participating companies. The natural gas requirement will be 0.35m^3/day which will be made available by ONGC at concessional rate. It is expected that the project will commence sometime in October, 1989 and is expected to be completed within 3 years.

Plans to set-up alcohol based chemical plant to produce 10,000 MTPA of 2-ethyl hexanol and 40,000 MTPA of styrene along with small quantities of other allied products, have been finalised in consultation with the Government of Maharashtra. The Government of Maharashtra has already allocated 60 million litres of alcohol per annum and BPCL has committed for the supply of benzene required for styrene. The plant will use the latest methods developed by NCL for conversion of alcohol, 2-ethyl, benzene directly which is being done for the first time. The detailed TEFR has already been made and the estimated cost of the project is Rs. 160 crores.

A bagasse based news print plant will be set up in the Solapur District of Maharashtra in collaboration with Western Maharashtra Development Corporation, for which the land has already been identified. The approximate cost of the project will be Rs. 415 crores with an annual capacity of 1,15,000 MT of the newsprint.

Plant Optimisation:

RCF plans a major step forward in the use of computers for real time online process optimisation. The computer aided manufacture of ammonia for energy and cost optimisation has been attempted for the first time in the country both at Trombay and Thal. A sum of Rs. 2 crores is being spent on the project.

MOU Assessment:

RCF has signed a Memorandum of Understanding with the Government for the year 1989-90 which provides necessary flexibility and freedom for the company in its operations to achieve the planned objectives and at the same time giving adequate attention and due regard to the accountability expected for the company as an instrument of economic development. During the first quarter of 1989-90, the company has almost achieved the targets fixed under the MOU.

Industrial Relations:

The company continued its well set tradition for maintaining cordial relations between the workers and the management throughout the year. The company provides excellent work culture to the employees and handsome pay package which have helped in smooth operation of the plants.

Dividend:

The company in its 11th Annual General Meeting declared a dividend of Rs. 11.03 crores to be paid to the Government. During the 11 years of its existence, RCF has never faulted in the payment of dividend to the national exchequer. With this year's recommendation, the total dividend paid to the Government since the incorporation of the company stands at Rs. 86.97 crores.

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Chemical industry told to spend more on R & D

The Industry Minister, Mr. J. Vengal Rao recently called upon the chemical industry to upgrade its technology continuously for growth in the domestic sector as well as survival in the international market. He said the Government's efforts to encourage local development of new technologies and reduced reliance on outside sources would save foreign exchange on one hand and create an industrial culture of high efforts in research and development on the other.

The Minister was presenting the awards for excellence in technology development and for best achievement in hazard and pollution control in the chemical industry. The year's award was bagged by a Bombay-based concern in the private sector. The award for best technology development carries Rs. 1 lakh and a plaque while a certificate of merit was given for best efforts in hazard and pollution control in the field of chemicals, petrochemicals and pharmaceutical industry.

Referring to the various national research laboratories functioning in the country, Mr. Rao said the Government wanted to make them the focus of expanding efforts in indigenous technologies. He called upon the industry to take full advantage of investments made in this field and keep a close liaision with those laboratories. At the same time, centres of research and development should be created for development of new technologies and upgradation of existing ones, he told the gathering.

He described the present investment for the purpose of R and D as "inadequate", and said investment needed to be increased by all units, specially the large and multinational units. Following liberalisation of industrial policy and delicensing of a large number of items of manufacture significant strides had been made of late by the chemicals and petrochemicals, he added. Mr. Rao said this year's export target for chemicals and allied products had been fixed at Rs. 3,240 crores which would be 54% higher than last year's. The Government, he pointed out, was looking upon this industry as a major foreign exchange earner.

Presiding over the function, the Environment and Forests Minister, Mr. Z.R. Ansari, said Government rules pertaining to manufacture, storage and import of hazardous chemicals and use of hazardous micro-organism were being finalised. He said after the Bhopal accident, a "crisis management plan" had been chalked out to deal with emergencies that might occur in units handling hazardous chemicals. A "red book" enlisting various steps to be taken during an emergency had also been prepared by Government and distributed to all concerned.

MARINE CHEMICAL COMPLEX PLANNED AT VEDARANYAM

The Tamil Nadu Government is planning to establish an integrated marine chemical complex at Vedaranyam salt belt in Thanjavur district revising its earlier proposal to have only a soda ash project in the place. The complex is to be set up by Tuticorin Alkali Chemicals and Fertilisers Ltd (TAC), a joint venture of TIDCO and SPIC. In all likelihood TAC may join hands with a private party to establish the new complex for which the details regarding investment, product line etc., are being worked out.

It is understood that the Tamil Nadu Salt Corporation also showed keen interest to bag the prestigious project. But, the State Government has preferred TAC keeping in view in infrastructure and technical capabilities at its disposal. The complex is expected to have a comprehensive product range, including soda ash, salt, iodised salt and other major marine chemicals.

PATALGANGA, RASAYANI UNITS SEEK RELIEF

The industrial units in Patalganga, excepting a few ones, have commenced production. The Patalganga and Rasayani Industries Association (PRIA) has urged Maharashtra's minister for industries to appoint a committee to go into problems of the flood-affected area.

The Association has suggested that industrial establishments in the area could be given some facilities and concessions in view of the difficulties they faced.

It has sought a waiver of fixed electricity charges till normalcy is returned, deferment of payment of electricity bills, waiver of deferment of sales tax for a period of one year from the date of commissioning the plant and long-term soft loans with minimum interest. Amount of soft loans should be determined on the basis of loss of each of the unit and retention of this area in 'C' zone for package incentives.

MAHARASHTRA BANS SIX DRUGS

The Drugs Control Laboratory, Maharashtra state, has banned the sale and distribution of six drugs. The banned drugs with batch number, expiry date and name of manufacturer in brackets are Depin Capsules, nifedipine caps USP, G-8018, March 1991, Cadila Antibiotics (Pvt) Ltd., Ahmedabad, Mayogard capsules, 55, October 1989, (SIL Pharmaceuticals (Pvt) Ltd., Bombay); Angilat Nifedipine capsules, P-123, December 1989. PCI Fine Chemicals (Pvt) Ltd., Ankaleshwar (Gujarat); Ceepusyn capsules, 8611,(Wilcure Remedies, Indore); Nifedipin capsules, USP 10mg., 1-808, March 1992, (Alkem Lab (Pvt) Ltd.); and Calamine Lotion, 602, (BDN Pharmaceuticals, Nagpur, March 1992), an official release said.

AIMO chief seeks redefinition of sick SSI units

A clear-cut definition of small sick units should be spelled out by the Government so as to enable banks and Government departments to render speedy assistance, says Mr. R.M. Dujodwala, President All India Manufacturers Organisation (AIMO).

A press release of the organisation says lack of clear-cut definition of a small sick unit today comes in the way of getting effective help from various sources when it is needed badly. Another major grouse of small sick units is that so far the Government had not published an authoritative brochure which can at one glance make it possible for owners of small units to know whom to approach and what relief can be expected from the various institutions as well as Government departments.

Today a lot of time is lost in making inquiries and owners of small sick units are not able to devote to their time full day. Sudden changes in import and export policy ignoring the share of indigenous and imported raw materials to SSI units in proportion to their contribution both to production and export and the inability of the National Small Industries Corporation to stock and supply raw materials with nominal holding charges are some of the areas which require immediate attention by the Government.

Banks and public sector undertakings play with the future of SSI units by not implementing the arbitration clauses, knowing the vulnerability of the small units to passage of time. This also applies to the refund of earnest money and other deposits where these departments are lackadaisical thereby reducing the already small financial resources of SSI units. The Government has, in all sincerity, encouraged a number of legislative measures which have not even touched the periphery of SSI units, largely because badly drafted legislation allows loopholes to be availed of by others outside this sector to the detriment of the smaller unit. Some of these to be briefly mentioned are modvat, excise relief announced in the Central Budget and price preference.

Mr. R.M. Dujodwala proposed that AIMO should take up the formation of cells consisting of successful and experienced industrialists along with persons of calibre in engineering technology and accountancy to identify the sick units and to recommend them to the banks for financial assistance. These cells will recommend only such sick units which can be made viable under financial assistance of the bank. Banks and Financial Institutions should reduce drastically the time taken by them to consider and approve proposals for assistance to sick units and to implement them speedily. There is dragging of feet in declaring a unit sick both by the bank as well as by the State Director of Industries and when banks are approached for further finance, they should help the SSI units for preparing techno-economic feasibility study at little or no cost.

The Reserve Bank of India is basically keen on helping sick units to come out of their travails. However, it is not strictly controlling the banks as well as the IDBI's bill rediscounting scheme in which unfortunately a SSI unit stands to be penalised even after paying a guarantee fee. Delays of every type weaken the SSI units whether it is village panchayats, municipal corporations, banks and government departments. Examples have been given where decision making takes years which is totally unacceptable. External factors which contribute to the sickness of SSI units include Government regulations, product and price control, uncertainty in market conditions on account of changes in Government policies, high incidence of indirect taxes and natural calamities.

GUJARAT PETROCHEM PROJECT OKAYED

The Centre has cleared the Rs. 2,200-crore petrochemicals project of the Gujarat Government. This was disclosed by the State Energy Minister, Mr. Harisinh Mahida, while talking to newsmen at Gandhinagar recently. The petro-chemical complex will be set up near Vagra of Bharuch district of south Gujarat, Indian Petrochemical Corporation Ltd., (IPCL) will look after its working. Several downstream projects, including a cracker will also be set up in this area, he added.

It has decided to set up two power stations of 600 mw each based on Gandhar gas and another 750 mw power station will also be set at Pipvav. The present installed power capacity in Gujarat is 430 mw. Even with the addition of 1950 mw, the total generation capacity will reach 6250. However, it will be difficult to meet the power requirement, Mr. Mahida said.

He pointed out that the Amul diary of Anand had applied for setting up of power plant on co-operative basis but this proposal has not been accepted by the Centre.

GSFC TO EXPAND CAPROLACTUM PLANT BY 1991

The expansion of India's only caprolactum project at the Gujarat State Fertilizers Company (GSFC) near Vadodara will be completed by the end of 1991. Disclosing this, Mr.P.V. Swaminathan, Managing Director of GSFC said when the Rs. 400 crore expansion would be completed, the existing annual capacity of 20,000 MT of caprolactum would be raised to 70,000 MT.

He said the expansion was based on West German technology and it involved foreign exchange of Rs. 85 crores.

Step-up in S & T investment likely

Highest priority is proposed to be given to Science and Technology in the Eighth Plan by stepping up the investment in this sector from the present one per cent of GNP to two percent of GNP. The budgetary support, however, will not increase propotionately as the Government is planning increasing "commercialisation" of research and development efforts.

The Minister of State for Science and Technology, Mr. K.R. Narayanan, disclosed that the Prime Minister, Mr. Rajiv Gandhi, has directed the Planning Commission to allocate more resources for the sector. The application of Science and Technology in agriculture as well as use of solar and non-conventional energy sources are expected to be given importance.

According to Planning Commission sources, if the present proposal of allocating two per cent of GNP to science and technology is finally accepted the investment in this sector will be raised to about Rs. 50,000 crores.

The focus of R & D effort in the Eighth Plan is also going to change in favour of applications useful to masses. The Seventh Plan had concentrated on frontier areas like atomic energy, space technology, ocean development, biotechnology etc. The reorientation had already started with the various technology missions, there was realisation then itself that fruits of S and T "are not reaching the bulk of the population and not contributing in sufficient measure to growth."

In the Eighth Plan, apart from expanding the technology missions to new areas, a new concept of "technology blending" to integrate the most recent advances in high technology with traditional approaches and skills is proposed to be introduced.

The Department of Scientific and Industrial Research, for example, is trying to import solar energy technology for pumping water from deep and shallow depths. The idea is that State Electricity Boards instead of incurring heavy investments on extension of power transmission lines to rural areas, could develop use of solar energy.

Both public and private sector companies are said to be hesitant to enter the manufacture of solar energy pumpset packets as they fear it might not be attractive to farmers. These packets require higher initial investment though the running expenses later will be practically nil.

A new incentive package both for the manufacture and users is being proposed to boost the use of solar energy oriented systems in various fields.

The R & D efforts would be directed to provide "new products, process knowhow, and in general, quality and reliability, improvements and increases, in productivity and efficiency."

While mass applications are to get priority, micro-electronics, biotechnology, new materials of high temperature super conductivity will also be simultaneously developed. Related to these is the problem of fall in demand as a result for several raw materials from industrialised countries. The Indian R & D effort is to be directed to find alternate uses for such raw materials.

GUJARAT NYLONS TO GO ON STREAM BY MONTH-END

The Rs. 119 crore Gujarat Nylons Ltd. (GNL), promoted by the Gujarat State Fertilizers Company (GNFC), a joint sector undertaking near Vadodara will be commissioned near Surat by the end of this month, according to the GSFC Managing Director, Mr. P.V. Swaminathan who is also the Chairman of the Gujarat Nylons project.

Talking to reporters in Ahmedabad, Mr. Swaminathan said that the project had a capacity to manufacture 6,000 MT nylon filament yarn (NFY) annually.

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JK Synthetics seeks Italian PTA knowhow

The Singhanias of JK Synthetics have approached Technimont of Italy for technology to manufacture purified terephthalic acid (PTA). The JK group is implementing the Saleempur aromatics project to produce two lakh tonnes of PTA.

This follows the failure of the JK group to rope in any of the three established licensors of PTA technology, Imperial Chemical Industries (ICI) of UK, Amoco of the United States and Mitsui of Japan. All three are said to be disinclined to participate in the Saleempur project for different reasons.

ICI has licensed its technology to Reliance Industries Ltd. (RIL), which is the sole producer of the polyester intermediate at present. It has recently entered into an understanding with RIL for supply of technology as well as buy-back of part of the output for the proposed 100% export-oriented project in Gujarat. ICI is also collaborating in two new PTA projects in Asia - a 2.5 lakh tonne project in Thailand and a 3.5 lakh tonne project in Taiwan.

Amoco recently pulled out of India by selling its stake in Madras Refineries Ltd. (MRL). It is not keen on returning to India, especially in projects where it will have only minority participation.

Mitsui has already been tied up with the MRL-SPIC joint venture which is promoting an aromatics project in the South. In view of the revision of minimum economic size for PTA for 1.5 lakh tonnes to two lakh tonnes, the Government has now returned the pre-PAB project report to the MRL-SPIC combine, asking for revised cost estimate based on the new capacity at today's costs. The project cost for the Saleempur and the Southern project are now estimated to exceed Rs. 1,100 crores.

Technimont, it appears has no lincensing in PTA projects. The Government now wants mega petrochemical projects to be implemented without recourse to institutional finance. The company is therefore expected to resort to a large public issue next year.

The Saleempur project will be based on naphtha to be supplied by the Mathura Refinery. Besides paraxylene and PTA, it will produce orthoxylene, cyclohexane and return raffinate. The MRL project has a similar product pattern.

More than half the PTA production of the Saleempur project will be consumed by JK Synthetics. Other PTA consumers in the North include India Polyfibres, Raymonds and Modipon. On the other hand, there are no synthetic fibre units in the South.

ICICI TO LAUNCH TWO NEW SCHEMES

The Industrial Credit and Investment Corporation of India (ICICI) will shortly come out with two new schemes, proposals for which have been submitted to the Centre for its approval, to usher in technological revolution in the country.

Inaugurating a one-day seminar on "role of technology in the development of small and medium scale industries" at the National Chemical Laboratory (NCL) at Pune on September 9, the ICICI Chairman, Mr. N. Vaghul said, the ICICI had submitted a proposal for launching "venture fund" scheme in the United States. This would help in undertaking work on projects, whose technology could be transferred to India, Mr. Vaghul said. He said the ICICI has also submitted another proposal under which an Indian entrepreneur could be provided foreign currency to acquire 'mismanaged' industry in the States. He said this would help the industrialists to make profit abroad and also bring in the technology back to India.

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INSECTICIDE ACT RULES:

Proposed changes may affect farm sector

Amendments to the Insecticide Act Rules proposed by the Ministry of Agriculture, if implemented, are certain to hamper agricultural operations. Clause 2 of the proposed amendment defines "pest control operator" as any person who disperses or applies insecticides manually or by any mechanical device for a consideration. It requires all such operators to possess a B.Sc., degree either in science or agriculture.

It is well known that farmers hire millions of farm workers to spray their crops. If the rules are rigorously implemented, hiring of these non-graduate workers would become illegal. The petty functionaries of the Government would then harass farmers. It appears the Government's motive in proposing the amendment is to ensure that there is no excess use of pesticides which have led to complaints from environmentalists. But the solution does not appear to be workable. Another amendment seeks to involve the agricultural inspector in customs clearance of imported pesticides. If adopted, it is likely to delay the clearance of imported consignments leading to non-availability of material when the farmer requires the same. The entire industry, especially those who formulate imported pesticides, are likely to be hit by these provisions.

According to Mr. Salil Singhal, Chairman of Pesticides Association of India (PAI), many foreign suppliers have expressed their unwillingness to provide the kind of affidavits which they are required to submit as per the amended provisions. They are also asked to give an oath and undertaking that the insecticide is safe and does not involve any risk to human beings or animals and that the precautions claimed for ensuring the safety are such as can easily be observed. This contradicts Rule 19 (8) of the Act which clearly states that "labelling of insecticides must not bear any unwarranted claims about the safety of the product - this includes statements such as safe, non-poisonous, non-injurious or harmless with and without such qualified pleas as and when used as directed." Similarly, they are required to give an undertaking that the product is used and manufactured in their country and is not banned or restricted in the country of its origin.

In its objections to the amendments submitted to the Government, PAI has said that during the last few years, hazardous products such as Endrin, Arsanate, Leptophos, Dialdrin and others have been banned or phased out. Also, applications for registration of some new chemicals have been rejected because safety and efficacy were doubtful in India. "In this situation, should we really be concerned when registering newer products and what is worse, seeking similar certification from foreign suppliers of products which are already registered in India and have been in use for years together?" Mr. Singhal asked. If the idea is to keep abreast of changes in product usage abroad, why should the Government insist on affidavits and undertakings?

Another amendment which has upset the industry is the one making directors or individual partners of the companies involved in pesticides business personally responsible for all documentation. This would mean that even for a sample which may fail the Government lab tests, the directors can be hauled up before the court, Mr. Singhal said.

"The proposed amendments will scare away further investments in the industry and its growth which are a must if we want our agricultural production to be protected against the ravages of pests and diseases," he said.

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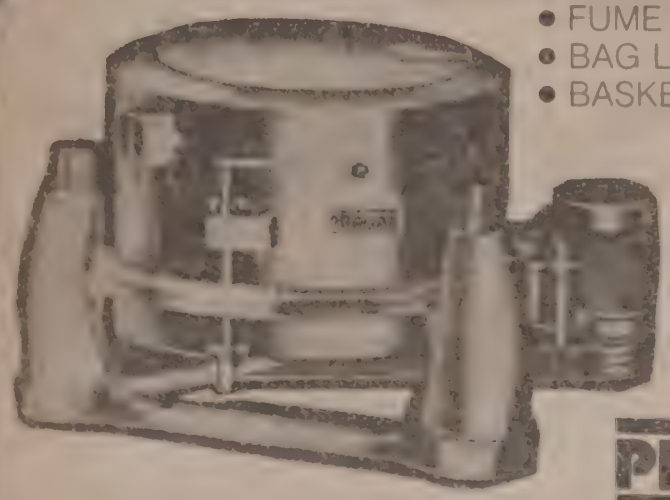

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Plans for petrochem joint ventures in W. Asia shelved

The Government has shelved plans to set up petrochemical joint venture in West Asia for the time being, it is learnt. This is because it finds that the move is not practical in view of the overall domestic and international scenario. According to official sources, the proposals for the joint ventures in West Asia could not really prove useful to India at present. The official feeling is that the country cannot afford to make any long-term commitments to buy back the end products, as the proposals envisaged. The argument was that the demand supply scenario would change in the coming years, with the Government having liberalised the licensing procedures, fixed higher minimum economic capacities and even cleared a spate of petrochemical projects in the country.

India had been considering proposals from Saudi Arabia, Qatar and Bahrain for setting up joint ventures in these countries. In fact, an Indian delegation under the Former Chairman of Indian Petrochemicals Corporation Ltd. (IPCL), Mr. J. Mehta, had even visited these countries a few months ago. It had found the prospects encouraging. After this visit, Saudi Arabia Basic Industries Corporation (SABIC) sent a team to India to further discuss the possibility. The SABIC was keen to tap the public sector IPCL and the private sector for the joint ventures.

The idea behind the proposals was that the projects would be helpful in meeting the Indian demand for petrochem products through buy-back arrangements. Another point against the proposals was that there was no guarantee that the country would continue to import petrochemical products on a long-term basis, as the policies could easily undergo changes. In addition, there was the apprehension that if the joint venture partners went on to form a cartel with other manufacturers, India as a minority partner would not be able to fight it.

An equally important argument, which is reported to have been put forth by the external affairs ministry, is that West Asia was setting up huge capacities in petrochemicals. This was true in the case of countries in South East Asia too, with particular examples being Thailand and Indonesia. For example, Indonesia has two big projects in the pipeline of which, one is a $ 1.5 billion olefins complex which would produce the basic petrochemical building blocks, ethylene and propylene, the second project.

An investment of $ 1.27 billion would produce 405,000 tonnes of benzene a year, 50,000 tonnes of toluene and 217,000 tonnes of paraxylene alone with smaller quantities of other xylene compounds. Thailand, on the other hand, is launching its second petrochemical unit, National Petrochemical Corporation-2 or NPC-2, even before the first, NPC-1, has gone on stream.

NPC-1 envisages an investment of $ one billion for an olefins complex with downstream polypropylene and other facilities. Likewise, the Chin General Plastics Corporation of Taiwan is proposing a $ 413 million naphtha cracker plant in Malaysia, with Thyssen Rheinstall of West Germany following suit with a proposal for investing $ 907 million in an export-oriented petrochemical project. This clearly indicates that the market in South East Asia would not be particularly encouraging. Even otherwise, in West Asia itself, the Gulf Organisation of Industrial Consulting (GOIC) has recommended the setting up of a number of petrochemical projects in the region to tap the world market.

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HPCL plans Rs. 3200 cr. expansion

The public sector Hindustan Petroleum Corporation Ltd. (HPCL) proposes to expand and diversify its operations at a cost of Rs. 3,200 crores during the Eighth Plan period.

The Corporation Chairman Mr. M.K. Bagai told newsmen at Vijayawada, on September 8, that the Centre had asked the Corporation to go ahead with the proposed Rs. 1,800 crores six million tonne capacity new refinery to be set up on the Maharashtra-Gujarat border. A decision would soon be taken whether it should be launched as a joint sector project or solely by the HPC, he added.

Mr. Bagai said another project proposed was a three million tonne naphtha-based refinery costing Rs. 1,540 crores at Mangalore, in collaboration with Indian Rayons for which Central clearance was awaited.

He said to facilitate large imports of liquified petroleum gas (LPG) the Corporation plans to lay a pipeline at the outer harbour of Visakhapatnam at a cost of Rs. 25 crores and construct an import terminal at Mangalore at a cost of Rs. 50 crores in the next two years.

These facilities were expected to meet the needs of oil-based industries in the South, he added. Mr. Bagai said the Corporation also plans to take up a Rs. 140 crores project to expand the Vizag Oil Refinery capacity from the present 4.5 million tonnes to six million tonnes in two years to meet the growing demands of petroleum products in the country.

As part of the diversification programme, the Corporation planned to set up a 23,000 tonne capacity plant to recover propylene from Visakha Refinery at a cost of Rs. 20 crores. It was expected to be commissioned by 1991. Another project to derive paraffin from kerosene to help detergents industry at cost of Rs. 110 crores was also underway at Visakha Refinery, he added.

A Rs. 13 crores project to recover sulphur from the sulphur dioxide emission from the Visakhapatnam refinery to ensure reduction in pollution and a Rs. 100 crores export-oriented one lakh tonne capacity plant to manufacture benzene were among the other projects in the pipeline, Mr. Bagai said. He said a captive generator with 20 mw capacity was being considered. To ensure uninterrupted power supply at the Vizag Refinery using the emissions from the refinery under the co-generation process.

EIL BAGS PIPELINE PROJECT IN GULF

Engineers India Ltd. (EIL) has bagged the prestigious gas pipeline project in Abu Dhabi, being put up by the Abu Dhabi National Oil Company (ADNOC).The project involves building a pipe 165 kms in length from Maqta gas terminal in Abu Dhabi to a power project in Al-Ain town of Abu Dhabi. EIL will provide complete services required for design, engineering, procurement, project management, construction and commissioning. This prestigious job, which will be completed in 18 months schedule, has been awarded to EIL in the face of stiff international competition.

Earlier, EIL had executed the AL-Ain multi products pipeline/depot project for ADNOC in the early eighties. Here at home, EIL has been associated as project management consultants for the prestigious HBJ pipeline project for Gas Authority of India (GAIL), besides serveral other pipeline projects. Besides pipelines, EIL has been working in Bahrain for the Bahrain National Oil Co. (BANOCO) for their gas reinjection project. EIL has also been working in Algeria, Iran, Iraq, Qatar and Malaysia on various projects related to petroleum refining, pipelines, petrochemicals and offshore engineering.

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New capacities for synthetic rubber

The Union Government will not impose unilateral ban on creating new capacities in synthetic rubber manufacture in the country, as it has to take into consideration the plight of the rubber user industry which is short of its raw material, according to the Joint Secretary in the Ministry of Commerce, Mr. M.R. Sivaraman.

"We cannot have a one-sided attitude on production of rubber. While it is true that the natural rubber producers are genuinely concerned over the creation of new capacities in synthetic rubber manufacture, we should also take into consideration the plight of thousands of people who are dependent on the rubber user industry," he told an UPASI session on plantation crops in Coonoor on September 4.

According to him, throughout the world the synthetic rubber use was far higher than that of natural rubber, even though in the Indian context the ratio may be different. Mr. Sivaraman was reacting to the Chairman of Rubber Board, Mr. P.C. Cyriac, who suggested a complete ban on creating new capacities in Styrene Butadiene Rubber (SBR), considered to be a perfect substitute for natural rubber.

Mr. Cyriac had wanted the Government to allow new capacities only in specialised synthetic rubbers such as butyl rubber and nitryl rubber which are more value. A number of industrial houses, including the Reliance group, the UB group, Shaw Wallace and Bennet, Coleman and Company, have sought permission to set up SBR plants in different parts of the country.

Mr. Cyriac had pointed out that apart from being a perfect substitute for natural rubber, the SBR was also costly to produce, as it involved four times the capital cost when compared with a similar capacity natural rubber plant and also involved foreign exchange outgo to a large extent. The SBR production also resulted in large-scale industrial pollution, the prevention of which would cost a lot of money.

According to Mr. Cyriac, the present demand-supply gap would easily be bridged by the natural rubber producers within the next three years. A series of steps had been initiated by the Rubber Board to enhance the present crop productivity by over 50,000 tonnes in just one lakh hectares planted by small growers. Apart from this, the large growers have also taken up intensive production of rubber which would improve the overall rubber availability.

He claimed that in the last five years natural rubber prices had been maintained at almost the same level with the average increase at just one per cent. He, however, cautioned that the mechanism of rubber prices regulation through cheaper import of rubber by State Trading Corporation may no longer be relevant considering the price situation in the world markets.

Mr. Cyriac was critical of the Karnataka Government's move to declare rubber and cocoa as forest produce. Terming it as a, "retrograde" step, Mr. Cyriac said it would only breed corruption and loss of interest by growers." The Rubber Board Chairman announced that the experiment by the Board to extend rubber cultivation in North Eastern states had produced positive results in that the very first year's tapping of rubber in the region had yielded as much as 1,000 kgs. per hectare. A total of 29,000 hectares have been brought under rubber cultivation in these states.

CHEMTECH TEAM TO VISIT FRANCE IN OCTOBER

In response to an invitation from Gep-Asteo of France, the Chemtech Foundation is leading a 15-member delegation to that country in the second week of October to identify areas of co-operation for joint ventures in fields of oil and gas, chemicals and rochemicals. Gep-Asteo is an professional association of 200 Fr Companies of oil, gas marine, p chemical, chemicals and geothe industries.

Mr. Surajit Chaliha, Chairman Managing Director of Oil India who has been elected the new presi of the Eastern India chapter of the f dation and who is leading the oil gas segment of the Chemtech del tion, told newsmen at Calcutta on tember 6, that the proposed tou France was in fact a return visit, similar high-level delegation of exp from France had visited India in ruary this year to participate in Ch tech'89 - India's seventh internati exhibition and conference for chem petrochemical, refining and pro engineering industries.

During its visit to four Centres France, namely, Paris, Lyon, Valenc Marseilles, the delegation propose hold in-depth discussions not only v respective Government departments also with concerned industrial orga sations in the field of oil and gas. visit, according to Mr. Chaliha, wa great importance in view of the indi tion available from the French that t were not only interested in selling also in buyback arrangements where possible.

Mr. Jasu Shah, president of Chemtech Foundation, said the Fren Government had set up a special bure with an initial funding of 10 mill Francs to assist Indian exporters to s their products in France and Fran phone countries. The French Govt. also extended two lines of mixed cre totalling 120 million Francs, in the p tocol signed last year, at a conce rate. Mr. Chaliha said Chemtech wo also organise a seminar in Calcutta opportunities in oil and gas sector Eastern India on the occasion of the c tenary celebration of OIL.

Indo-British talks on oil & gas

high-level Indian delegation, which esently in Britain, will hold wide-ing discussions with the represen-es of the British Government and oil industry to further increase co-ration between the two countries in and gas sector.

The delegation led by Mr. H.K. an, Secretary, Ministry of Petroleum Natural Gas, left for Britain on Sep-ber 2. It includes Col. S.P. Wahi, airman of the Oil and Natural Gas mmission (ONGC) and Mr. Vineet yyar, Chairman and Managing rector of the Gas Authority of India d. (GAIL), an official release said.

Some of the leading British compa-s have already indicated keenness to rticipate in various oil and gas ven-es in India and are expected to make esentions before the Indian delegation.

Several British companies have eady been identified in this regard. ese include British Petroleum and itish Gas for collaboration in deep ater offshore exploration, Mathew all and John Brown for engineering d design for offshore platforms, ingsby and Yard for remote interven-n system design, and FSSL and GEC r sub-sea control systems.

The Robertson group is being con-dered for joint ventures in enhanced l recovery techniques. Possibilities of int ventures between the Oil and Nat-al Gas Commission (ONGC) and infrith Petroleum Technology for velopment of software and integrated servoir management are also being amined. Some of the British compa-es like British Petroleum are being nsidered for consultancy in refineries n a retainership basis.

ICH NATIONS' OIL CONSUMP-ION UP

The robust health of western econo-ies this summer has accelerated indu-strial nations' oil consumption, says, the International Energy Agency (IEA).

During the second quarter, the daily demand for oil in the Western nations reached 5.8 million barrels, two per cent higher than the second quarter 1988 level, the IEA said on September 6.

Moreover, the agency predicted that in the third quarter of 1989, Western oil consumption would be three per cent higher. The IEA predicted that Western oil consumption for 1989 would average 37.6 million B/D, a two percent rise over last year's figure, while in developing nations, consumption would be four percent higher at an average of 14.5 million B/D.

In August, world oil supplies averaged 52.7 million B/D, or about 500,000 barrels above the July daily average. The IEA said it expected this supply to prevail for the third quarter.

The share of the Organisation of petroleum Exporting Countries (OPEC) in the world supply rose by 200,000 barrels in August to 21.6 million B/D, mainly due to a rise in Iranian oil deliveries.

The IEA said that in September, Iraqi deliveries will be rising by some 1.5 million B/D with the opening of a new pipeline through Saudi Arabia. On free market, crude oil at the end of August was running some $ 0.60 per barrel higher than in June.

OPEC PRICES MAY GO UP

The OPEC Secretary-General, Dr. Subroto, told OPEC Oil Ministers recently that he expected the average price of the organisation's crude to rise to $ 18 per barrel, up from around $ 16.5 at present, an OPEC secretariat source said.

Dr. Subroto told the ministers that because of quota violations, OPEC production was close to 22 million barrels per day, but as strong demand was absorbing this, he was convinced that the target price of $ 18 would be reached by the end of the year, the source said.

Participants in the informal talks, held on the fringes of the Non-Aligned Summit in Belgrade, included Dr. Subroto and the oil ministers of Algeria, Indonesia, Nigeria and Venezuela.

Their discussions followed bilateral contacts in Belgrade, by the heads of state of those four countries, in which oil market trends, OPEC's attempts to draw up a new long-term price and production strategy, plans for a full OPEC summit and the forth-coming ministerial meeting of the OPEC market monitoring committee on September 23, in Geneva were discussed.

The monitoring committee is expected to face calls from some OPEC countries for an increase in the organisation's self-imposed 19.5 million barrel per day production ceiling by 500,000 or 1 million BPD.

15 COS. TO DISPLAY PLASTIC PRODUCTS AT "K-89" FAIR

Indian Companies for the first time will participate in the prestigeous eight-day-long "K-89," the 11th International Trade Fair for Plastics and Rubber, beginning at Dusseldorf from November 2.

As many as 15 Indian companies under the supervision of the Trade Fair Authority of India (TFAI), would display wide range of products at the Dusseldorf Plastic Trade Fair, which attracts world-class raw material producers, machine manufacturers and processors of rubber and plastics. So far India had only been a visitor in the Dusseldorf Trade Fair for Plastics, held once in every three years.

Three firms bid for Hazira cracker

Three out of the four leading petrochemical engineering companies with cracker technology - Lummis Crest, Kellog and Stone and Webster - have placed their bids for setting up Reliance Petrochemicals Ltd. (RPL)'s Rs. 800-crore natural gas liquid (NGL) cracker at Hazira, Gujarat. The fourth, Linde AG of West Germany, has opted out on the ground that it has several other projects on hand.

With more than three grassroot crackers on the drawing board (no other country is contemplating so many at a time), India has emerged as a leading market for these companies who form an exclusive club of technology suppliers for petrochemical projects.

The following are the new integrated cracker-cum-petrochemical projects to come up in the near future: A gas cracker at Auraiya in Uttar Pradesh (to be implemented by Gas Authority of India Ltd.), a naphtha cracker at Visakhapatnam (earmarked for the UB group of Vijay Mallya) and another gas cracker based on Gandhar gas to be implemented by Indian Petrochemicals Corporation Ltd. (IPCL) in Gujarat. IPCL's (and India's first) gas cracker is to be commissioned by the year-end at Nagothane in Maharashtra. Also, both IPCL and NOCIL are planning to increase the capacities of their old crackers.

Kellog's is a new face on the Indian scene. Lummis Crest built IPCL's old naphtha cracker at Baroda, while Stone and Webster is setting up the gas cracker at Nagothane. Little is known about the fate of the export-oriented naphtha cracker-cum-downstream projects of the R.P. Goenka group with equity participation from Linde.

Linde is yet to make a positive statement confirming its continued involvement in the project. Neverthless, the RPG group has gone ahead advertising for professionals to man the project. Linde's reluctance is explained by the reaction such a venture might have on its customers like Bayer and Hoechst. Linde is a purely engineering and service company and has not, so far, threatened to compete with its clients by producing the latter's products. In any case, industry sources are unanimously sceptical of the EOU's ability to export massive quantities of downstream products to the international market.

A grassroot cracker normally takes about three years for commissioning. For the first phase of the RPL project (to produce MEG, PVC and HDPE), the company may have to resort to imported ethylene. The Government recently waived the 180% customs duty on ethylene imports which will help companies like RPL and Finolex.

With the entire throughput of the Hazira cracker at its disposal, RPL proposes to produce a host of products like styrene butadiene rubber, polystyrene, LLDPE, butyl rubber, polypropylene and acrylonitrile. It has received letters of intent for all these. It has now applied for two more polymers, ABS resin and polyacetal. The downstream units of the Auraiya cracker are likely to be shared among the Birla group, Bhartias, RPG group and the Singhanias, according to reports reaching Bombay from Delhi.

KRISHNA-GODAVARI BASIN: RS. 227-Cr. GAS PRODUCTION PLAN FOR ONGC

The Oil Natural Gas Commission (ONGC) has proposed a Rs. 227-crore gas production scheme for the development of the Tatipaka - Pasarlapudi structure in the inland Krishna-Godavari basin in Andhra Pradesh. The proposal envisages creation of production and processing facilities for supply of 2.5 million cubic metres of gas per day to the Nagarjuna Fertilisers and Chemicals Ltd. (NFCL) and other consumers.

ONGC sources said transportation facilities had been designed for su of four million cubic metres of gas day from Tatipaka to Gudala and 6 lion cubic metres from Gudala to K inada to take care of future product from Ravva, Chintalapalli, Tatipaka other undrilled prospects.

The Tatipaka and Pasarlapudi p spects are located about 22 kms n east of Narsapur town. In 1980, gas discovered in both these structur According to the sources, the geolo cal reserves for these prospects w estimated to be about 12.68 billion cu metres. So far, seven wells have b completed on these structures, three Tatipaka and four on Pasarlapudi.

ONGC's strategy is to prepare t field for production of 1.32 milli cubic metres of gas per day immediate and subsequently ungrade the reserv to reach 2.5 million cubic metres a da The project entails drilling and compl tion of 19 development wells, a gas co lecting station and about 100 kms new trunk pipelines.

The sources said the gas demand nea the Kakinada area was put at 115 mi lion cubic metres per day. Sizeable dis coveries of gas had been made in th Razole, Narsapur, Tatipaka, Pasarlapud and Mandapetta structures, they said

IPCL LAUNCHES NEW PRODUCT

The Indian Petrochemicals Corpora tion Limited (IPCL) launched recentl at Baroda a new product called "aque ous acrylic acid" thereby becoming th first company in India to make thi product for sale, an official spokesma said.

The product, obtained as an intermed iate stream from IPCL's acrylates plan is a clear colourless liquid used in th manufacture of glacial acrylic acid. Gla cial acrylic acid in turn is used in leathe and textile auxiliaries and adhesives, a super adsorbents and in detergent for mulations.

GAIL to market LPG

The Petroleum Ministry has decided n principle to allow Gas Authority of ndia Limited (GAIL) to market LPG to consumers directly which will strengthen its financial position considerably.

A decision on the share of LPG marketing to be allowed to GAIL is to be taken by the Oil Co-ordination Committee shortly. Although LPG marketing takes nearly 90% of the time and energy of the existing three oil companies, GAIL would stand to gain substantially by way of deposits collected from the consumers. Each LPG connection brings Rs. 500 as deposit from the consumer on which no interest is paid by the oil companies.

GAIL has initially proposed to market LPG in eight states. These are Uttar Pradesh, Delhi, Madhya Pradesh, Rajasthan, Gujarat, Haryana, Punjab and Maharashtra. It has sought 50 dealerships in the current financial year and is seeking 100 dealerships in the next year.

GAIL is already in the process of setting up two LPG production units at Bijaipur as part of the petro-chemical complex coming up there. The two units together will have a capacity of four lakh tonnes of LPG per annum. The first phase of two lakh tonnes will be commissioned in October 1991 and the second phase of another two lakh tonnes in November 1991.

No bottling plants are, however, proposed to be set up by GAIL for the time being since there is enough bottling capacity coming up in the country. GAIL would be marketing LPG bottled by other oil companies.

Since LPG demand is going up at a fast rate, GAIL should have no problem in marketing it. The Petroleum Secretary, Mr. H.K. Khan, has recently said that the demand for LPG should increase from 2.2 million tonnes by the end of the Seventh Plan to about 3.6 million tonnes by the end of the Eighth Plan. There are already 46 lakh customers on the waiting lists of oil companies.

According to Mr. Khan the domestic LPG production by the end of the Eighth Plan will be around 2.7 million tonnes. This would leave a gap of nine lakh tonnes between demand and production.

One alternative being considered to meet this shortfall is to import LPG. The problem, however, is lack of handling facilities at import points. The present handling capacity is only about three lakh tonnes.

These handling facilities are proposed to be augmented by opening new LPG terminals. Indian Oil Corporation's proposal for a LPG terminal at Kandla has already been cleared. In addition, the other oil companies are proposing terminals on the Western and Eastern coasts. By 1994-95, capacity to handle about nine lakh tonnes of imported LPG is expected to be created.

Skid mounted LPG units are also proposed to be tried to tap small gas sources. An experiment in this regard is being initiated by IBP with three pilot units during the next two years.

BPCL TO MARKET CRL PRODUCTS

The Indian Oil Corporation (IOC) has ceased to have the monopoly over marketing of Cochin Refieries' Ltd. (CRL) products in Kerala. The marketing rights will hereafter be vested with Bharat Petroleum Corporation Ltd. (BPCL). The decision to transfer the 27-year old marketing rights in the State was taken by the Union Ministry of Petroleum.

The Chairman of the Cochin Refineries, Mr. Jayaraman, confirmed to the press, that the refinery has received communication from the Ministry regarding the transfer of marketing rights. He also welcomed the decision.

Speculation is, however, rife with the transfer of marketing rights to BPCL. There were some problems between the Cochin refineries and IOC when the former reportedly tried to market benzene directly. This was futile and since then, the Cochin Refineries had been trying to deny IOC the rights of marketing other petroleum products too.

Mr. Jayaraman, however, strongly denied the cold war with IOC. "We have the best relations and there have been absolutely no problems whatsoever between us", he asserted. Mr. Jayaraman, significantly, is from IOC.

The modalities of the transfer of marketing rights from IOC to BPCL are yet to be worked out. But in regard to product availability, the latter was in a more advantageous position, he added.

With the loss of marketing rights in Kerala, IOC will have to confine itself with the marketing of a single South Indian refinery's products. Under the new arrangement, IOC will have the rights of Madras Refineries, BPCL will have that of Cochin Refineries and HPC that of Vizag refinery.

Informed sources said IOC was not keen to enlarge its storage capacity in Cochin and hence, the transfer of marketing rights to BPCL by Cochin Refineries.

On the other hand, BPCL is expanding its storage capacity in Kerala. The BPCL's Cochin project at Irumpanam is expected to be completed in a year or two.

Till now, IOC announced for over 60% of the sales of petrol and diesel in Kerala. In regard to distribution of LPG also, it has dominated the Kerala market. The scenario is in for a thorough change thanks to the transfer of marketing rights.

Oil India strikes rich in Assam

The story of the Oil India Ltd. (OIL), whose antecedent companies discovered and developed the Digboi Oil Fields in Upper Assam, would culminate in the centenary celebration of the Indian Petroleum Industry to be inaugurated by the Prime Minister, Rajiv Gandhi, on November 4, next.

The story of the Digboi oil fields began in March 1867, when Goodenough of McKillon Stewart and Company struck oil at a depth of 118 feet at Joypur in Upper Assam, near the Digboi Oil Field. The Joypur well soon dried up and sporadic exploration did not bear fruit until Digboi.

OIL never looked back since then and on January 1989, the reserves of the oil field stood at 47.93 million tonnes, while the gross ultimate recovery was 12.37 million tonnes, OIL sources said.

The sources said that the cumulative production from the oil field in the last 100 years had been 11.74 million tonnes while the recoverable reserves were 0.63 MTs.

The sources narrate an interesting anecdote as a possible clue to source of the name Digboi. It is said that an elephant of the then Assam Railways and Trading Company, which went through the jungles carrying logs, returned to the camp with oil on its feet.

When the masters of the animal retracted the pachyderm's steps into the forest and found bubbles of oil seeping through the ground, an Englishman exclaimed "dig boy, dig", unaware of the fact that he had already found a place in the country's petroleum history.

Though the Digboi oil field was transferred to the OIL in a state of decline, the OIL adroitly took steps to arrest the rate of decline. A thorough study was made of the geological and reservoir engineering aspects of the field and systematically enhanced oil recovery (EOR) techniques were applied, the sources said.

Innovative EOR schemes such as LPG condensate flooding were tried out on an experimental basis in a pilot scale. After analysis of the reservoir, geometry rock properties and fluid characteristic, a particular reservoir was selected for "miscible flooding" using LPG condensate slugs.

In 1985, the injection of condensate available for OIL's Duliajan LPG plant was started through well and injected well system. A few nearby wells were observed for their pressure, production and injection rates to look for any benefit arising out of the LPG condensate flooding.

In future, the OIL plans to drill two wells of about 1,800 metre depth at Digboi in early 1990. These wells would be cored to gather relevant information for formulation of a EOR strategic plan to improve the recovery of the oil field, the sources said.

At present, at least 240 oil wells out of 684 were on production. For the past three years, the Digboi oil fields had been producing at the rate of 0.03 million tonnes of oil per annum. The oil, drilled from a very shallow zone, has a high content of wax, which is extracted at the refinery. It is the country's only refinery producing slabs of wax.

However, the cost of production in the Digboi oil field is much higher than normal. The sources ascribe this to the outdated installations which require more labour.

With the adaptation of newer technology, a large chunk of the 400-strong manpower was diverted to the Jorajan oil field. Experts hope to further curtail production cost with the application of new EOR methods and drilling of new wells to improve the recovery factor of the field.

Despite drawbacks, the oil fields' production of 0.03 million tonnes of crude oil saves the country Rs. 7 crore annually in foreign exchange.

The November centenary celebration would be held with support from the Ministry of Petroleum and Natural Gas, Oil and Natural Gas Commission (ONGC) and Indian Oil Corporation (IOC).

The Union Minister of State for Petroleum and Natural Gas, Brahm Dutt, is the Chief Patron of the commemoration programme, while the Secretary of the Ministry of Petroleum, H.K. Khan, is the Chairman of the Advisory Committee.

Officials said a commemorative stamp on the history of the discovery of oil in the country would be released and the Digboi oil field would be declared a national oil park.

FIRST LOT OF IRANIAN AMMONIA SHIPPED TO INDIA

An ammonia consignment weighing 72,000 tonnes was exported to India on September 6, according to the Iranian national Petrochemical Industries sources.

The ammonia produced by Razi complex in Bandar Iman Khomeini, Southwest Iran, was the first consignment exported since the 1979 Islamic revolution.

Its annual capacity is 495,000 tonnes of sulphur, 720,000 tonnes of urea and 660,000 tonnes of ammonia.

Some 260,000 tonnes of sulphur produced by the complex was exported during the last Iranian year (ending March 20, 1989).

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Domestic crude oil output to go up to 50.74 MT.

Domestic crude oil production will go up from 34.31 million tonnes in the last year of the Seventh Plan to 50.74 million tonnes in the last year of the Eighth Plan, according to the estimates made by the sub-group of exploration and development of oil and gas in the Eighth Plan set up by the Planning Commission. Similarly, gas production in the last year of the Eighth Plan is expected to be 33.59 billion cubic metres/day against 13 billion cubic metres/day in the terminal year of the Seventh Plan.

The increase in crude oil production would, however, not be sufficient to meet the demand projected to increase to 78 million tonnes by the end of the Eighth Plan. The indigenous production will be able to meet only 65% of the demand in 1994-95, the last year of the Eighth Plan against 66% in 1989-90, the last year of the Seventh Plan.

The level of self-sufficiency will fall further if, by the turn of the century, the growth in the demand of petroleum products is not checked by an effective inter-fuel substitution, energy conservation and efficiency in the use of energy, the sub-group has observed.

The long-term energy requirements scenario calls for urgent need to implement strict demand management measures. With adequate resource base of natural gas and the already established potential for production, it is expected that natural gas will be an effective inter-fuel substitute for oil in the power, industry, fertiliser and domestic sectors. Urgent steps are required to be taken for developing the necessary downstream infrastuctural facilities for gas utilisation, so that the available potential of natural gas is effectively utilised.

The sub-group has estimated that crude oil production of the Oil and Natural Gas Commission (ONGC) will increase from 31.61 million tonnes in 1989-90 to 46.86 million tonnes by 1994-95. The onshore production is estimated to increase from 9.71 million tonnes to 15.36 million tonnes and offshore production from 21.90 million tonnes to 31.50 million tonnes in the same period.

Production of crude oil by Oil India Limited (OIL) is estimated to increase from 2.70 million tonnes in 1989-90 to 3.38 million tonnes in the last year of the Eighth Plan.

The cumulative domestic production of crude oil will go up from 157.38 million tonnes in the five years of the Seventh Plan to about 215 million tonnes in the five years of the Eighth Plan.

The bulk of ONGC's crude oil production in Eighth Plan will continue to come from Bombay High as in the Seventh Plan. Production from Bombay High is projected to increase from 22.75 million tonnes in the first year of the Eighth Plan to 30 million tonnes in the last year. Krishna-Godavari and Cauvery offshore areas are estimated to produce 0.75 million tonnes of crude oil each, taking the total offshore production of ONGC to 31.50 million tonnes.

Similarly, in onshore areas, the well-known Cambay basin will account for 9.70 million tonnes of total onshore production of 15.36 million tonnes for ONGC in 1994-95. The rest of ONGC's production will come from upper Assam (4.21 million tonnes) and Krishna-Godavari, Cauvery and Cachar and Meghalaya areas.

A step-up of 62% in exploratory and 100% in the development efforts has been suggested by the sub-group. On the whole, nearly 1337 exploratory and 2282 development wells will be drilled with a total metreage of about 9.43 million. The number of rig years required for undertaking the drilling task of such a magnitude will increase from 192 at the start of the Eighth Plan to 243 at its end. A significant aspect of the increase in the number of rigs will be that almost all the new rigs to be inducted during the Eighth Plan are proposed to be on charter-hire basis.

The total plan outlay for oil and gas exploration, development and research in the Eighth Plan has been estimated at about Rs. 29,171 crores. Of this, Rs. 15,219 crores is proposed to be spent on capital acquisition. The internal resources of ONGC and Oil India available for this purpose have been estimated at Rs. 20,976 crores, leaving a deficit of Rs. 8,194 crores.

The deficit is proposed to be covered by realisation of investment available at the beginning of Eighth Plan estimated at Rs. 3,787 crores from World Bank assistance and loans, suppliers credit and an increase in the crude oil price allowed to ONGC and Oil India.

Without specifying the quantum of price increase that could be allowed to ONGC and Oil India, the sub-group has observed that while international crude oil prices have suffered ups and downs due to market forces, crude oil prices in India have generally remained much below the international level.

Since 1981, the sub-group has observed, national oil companies in India have been receiving a retention price of about Rs. 970 per tonne against international prices varying from Rs. 2,572 per tonne in 1985 to as low as Rs. 1,429 per tonne in 1986. The current average ruling international price is about Rs. 2,200 per tonne.

The revisions since 1981 have only been on account of cess and royalty which accrues to the Central and State Governments. Share of the oil companies, ONGC and Oil India, in the gross crude oil prices has, in fact, gone down from 83% in 1981 to 46% in 1989, the sub-group has observed.

aharashtra State Electricity Board plans three gas-based power plants

he Maharashtra State Electricity rd (MSEB) has submitted proposals he Union Government for setting up -based power plants at Uran, Dabhol Chola with a total capacity of about 00 mw, according to Mr. P Abraham, airman, MSEB. These three power nts would consume about 10 million bic metres of gas per day.

These proposals have been mooted eping in view the substantial addition generation capacity to be created near e load centre in order to meet not only e power demand but also to ensure tter quality in supply of power.

Any breakdown of power supply in e Bombay region would cause not ly loss of industrial production but so would cause untold misery to the tizens of Bombay, as witnessed in the cent past.

Substantial power generation from e natural gas available from the ombay High and other nearby oil elds could help in preventing break-own in power supply, Mr. Abraham id.

Mr. Abraham has favoured the Gov-rnment should fix a reasonable price r the gas to be allotted for the pur-ose of power generation. On commiss-ning of the power stations, peak emand can be successfully met as these tations can be also be operated as peak ad stations.

In his view, establishing gas based ower plants near the load centres would be a more ideal and economical olution to supplement the task of ransmitting the bulk of the power from he extreme eastern parts like Chandra-ur, to the Bombay region with the help f extra high voltage transmission lines.

MSEB has envisaged investments of the order of Rs. 7,000 crores in the Eighth Plan, compared with Rs. 2,658 crores in the Seventh Plan. It is also vital to allocate larger share of investments in the field of transmission and distribution in order to improve the quality of supply to various consumers, Mr.Abraham said.

Speaking at a discussion on, "Energy scenario in Maharashtra in the Eighth Plan", organised by the Indian Merchants' Chamber at Bombay recently, Mr. Abraham said that private participation in power sector should be encouraged, keeping in view the capital intensive nature of power sector.

For this, the Indian Electricity Act needed to be amended, as the act did not permit private sector participation in transmission and distribution of power.

The total addition to the generating capacity during the Eighth and Ninth Plans in the State power sector would be 3,888 mw and 4,890 mw respectively. Even then, the State would face a peak power shortage of 1,100 mw by the end of 1990, and a shortage of 1,650 mw by the end of Eighth Plan Mr. Abraham said. Also to improve peaking capacity in power system, it was vital to have more pump storage stations, he added. Maharashtra enjoyed a hydro/-thermal mix of 20:80 compared to the national mix of 40:60.

Mr. Abraham pointed out that power position in Maharashtra has been satisfactory but not comfortable. The installed generation capacity in the State was 7,658 mw, and the peak demand was of the order of 5,500 mw.

A 1,500 mw 500 kv high voltage direct current (HVDC) transmission link of 700 km between Chandrapur and Padghe, near Bombay, would be constructed during the Eighth Plan. The State needed to improve its transmission and distribution network, he said.

Earlier, in his welcome address, Mr. Rohit J. Patel, President, IMC feared that the power situation in the State could take an adverse turn if additional power generation capacities were not created.

To meet the 10 per cent annual growth in power demand, annual investment of Rs. 800 crores would be required to create additional power generation capacity of 500 mw per annum. He also called for improvement in plant load factor (PLF) transmission and distribution losses.

Mr. C.P. Kulkarni, Senior Manager (Systems), Tata Electric Companies, said the TEC was proposing to build pump storage hydro power unit at Gira, and Vipuri. Gira unit would help in preventing load shedding in Bombay. He called for improvement in load factor.

In his address, Dr. T.P.S. Rajan, General Manager, the Bombay Gas said Company that coal slurry pipeline was proposed to be built for Chandrapur thermal power station.

He lamented that enough research was not being carried out to lower the ash content in non-coking coal.

J.B. CHEMICALS

J.B. Chemicals and Pharmaceuticals has fared better during the six-month period ended June,1989. The gross profit has risen to Rs.144.70 lakhs from Rs.124.88 lakhs in the same period last year following an increase in sales to Rs.18.16 crores from Rs.17.16 crores.

The net profit is, however, lower at Rs.63.47 lakhs against Rs. 75.50 lakhs after higher provisions for depreciation (Rs.46.66 lakhs against Rs. 37.38 lakhs) and taxation (Rs. 34 lakhs against Rs. 12 lakhs).

Importance of rural energisation policy stressed

"It was time the country has a rural energisation policy and not merely rural electrification, Dr. M.S. Swaminathan, agricultural scientist, said at Madras on Sept. 5. "We have to think hard on the energy options in our country," he said. Energy would be a key factor in future development but it did not mean only electricity but other forms of energy as well. The rural energisation policy should be a mix of biogas, biomass and mini-hydel plants. "How are we going to have a green energy policy?" he asked.

Inaugurating a three-day workshop on "Futurology," organised by Anna University with reference to India's future in energy, space and biotechnology, Dr. Swaminathan said that futurology over the next 25 years would depend on "environmental capital stocks and human capital." The damage inflicted on the environment in the recent past was much more than was done in the last 16 years. There should not be any depreciation in environmental capital and if depreciation was allowed, it should be recoverable in terms of land, water, flora and fauna. The human capital was also undervalued in India and universities should present a new vision in this respect.

Mangroves Vanishing:

Energy, space and biotechnology had implications in sustainable development. "Bio-diversity was the foundation of biotechnology." Genetic engineering was the hardcore of biotechnology and the latter has some problems with regard to environment but they were manageable. For instance, ocean-warming might cause a rise in the sea-level, leading to sea-water incursion. But it could be checked by creating mangroves. "Pitchavaram in T Nadu is one of the greatest reposit of mangrove species but they are appearing," he said.

"If you lose the mangrove genep you have lost a great opportunit benefit from biotechnology. If the n groves are not there, where will you the genes for tolerance to seawat asked Dr. Swaminathan, who is Pro sor Emeritus, Centre for Biotechnol Anna University.

With regard to space, he said, e maous data was available by mean remote-sensing. But this data on drinking water availablilty, etc., had been converted into information would benefit administrators and ex sion scientists. There was a big between data and information for a ysis and interpretation for practical Anticipatory research should be essential component of futurology if country were to get the full bene from its investment.

For example, the construction of Indira Gandhi Canal in Rajasthan not take into account the enormous p blems it brought in its wake — siltat salinity, etc.

Need for visualisation:

Dr. V.C. Kulandaiswamy, V Chancellor, Anna University, who p sided said that science and technol had accelerated the basis of devel ment. Hence the need to visualise w would happen in future and meet eventualities. Till some time ago, peo thought of only hydel and ther power.

But today nuclear power had b accepted as a source of energy. F years ago, nobody would have thou of gas as one of the sources of ene but now gas was one of the major s ces of energy. Remote-sensing essential to a developing country s as India because it offered the cur maps of a town or a forest. This impossible in conventional metho

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Call to focus on small, medium units

Mr. Anand Bhadkamkar, Development Commissioner (Industries), Maharashtra, has said that the time has come for the State Governments to train small and medium enterprises (SMEs) in various aspects such as resource management and developing a fruitful relation with the large units. He has called for equal attention to be paid on the qualitative aspects of SMEs, apart from the quantitative aspects.

Delivering his presidential address at a seminar on small and medium enterprises jointly organised by Krditanstalt Fur Wideraufbau (KFW) and the World Assembly of Small and Medium Enterprises (WASME), sponsored by the Industrial Credit and Investment Corporation of Inda (ICICI) at Bombay recently, Mr Bhadkamkar, emphasised the need for giving technological thrust to the small sector to make it more internationally competitive.

Mr. Bhadkamkar felt there was no reason to get unduly alarmed at sickness in small industries. This was inevitable in a growing economy like ours, he said. Even 30 percent sickness rate should not cause alarm, he pointed out.

In his inaugural address, Mr. N.J. Jhaveri, Deputy Managing Director, ICICI, said that the impact of technological innovations and new demand structures would greatly influence the future of small and medium enterprises in the country. Explosion of knowledge, technology and management would have a profound effect on SMEs, according to him.

Mr. Jhaveri, said that SMEs no longer operated in low technology areas. Silicon Valley in the US was dominated by nearly 90% SMEs. Old concepts of SMEs were out-dated, and they were taking a new look at the emerging global and national technology-intensive environment.

Mr. Jhaveri emphasised the growing importance of service sector. He also underlined the emergence of new class of entrepreneurs, technically qualified, demanding and ambitious. He cautioned the banking industry against continued assessment of an entrepreneur's capabilities only on the basis of post track record.

Dr. W. Schumann, Consul General of the Federal Republic of Germany (FRG) in Central and Western Indial, said that 1988 was a landmark in the development of Indo-German trade, touching Rs. 4,080 crores and marked a further decline in India's trade deficit with FRG, by Rs. 918 crores. The trade between the two countries was likely to touch Rs. 5,000 crores in 1989, according to him.

Since 1988, 178 technical agreements were signed between the two countries, including 47 joint ventures. During the first six months of 1989, 72 Indo-German collaborations were signed of which 23 were joint ventures with a total investment of Rs. 110 crores, Dr. Schumann said. He emphasised tremendous scope of co-operation among SMEs of both the countries, a sector whose potential has not been tapped fully. Dr. Wolf, Senior Director, KFW, and leader of German delegation in India, said that three seminars in Delhi, Bombay and Madras organised by KFW and WASME would open new vistas of intensive co-operation between SMEs of the two countries.

VITRO PHARMA

Vitro Pharma has fared well during the year ended March 1989. The directors have increased the dividend to 21% from 10% paid last year. While sales and other income have grown by 74% over to Rs. 10.92 crs. from Rs. 6.27 crs., the net profit has grown more than proportionately from Rs. 18.77 lakhs to Rs. 54.94 lakhs, a growth of 193%.

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POLLUTION CONTROL

Environment cess — a new approach

The control of pollution will be successful when the pollution control laws are strictly implemented and there exists a tremendous awareness among the public. Ample funds must also be available for the implementation of these laws. In the developed countries, public awareness is strong, the laws of the land are fairly strictly implemented, and the funds for implementation of the laws are available says a report in the **Economic Times.**

In the developing countries, public awareness is good but not strong enough, and funds are available but are inadequate. Ample legislation to control pollution has been enacted in India, but their implementation has not been effective owing to a number of reasons. Therefore, a different approach has to be found to solve the problems of pollution, which is increasing day after day. One approach is to impose economic sanctions on those causing pollution.

Each citizen has an inescapable social responsibility to preserve environment. A polluter has no right to exploit the natural resources to his profit, if he deteriorates the environment with harmful wastes. He should be obliged to bear the cost of cleaning the environment, proportionate to the environmental damage he causes.

The permissible limits for water, air and land pollution are prescribed by the central and state pollution control authorities. If a polluter exceeds these limits, he should be liable to pay for the damage proportionate to the excess pollution he causes, besides undergoing penalties provided for in the concerned laws.

Under this principle, the pollution control authority i.e., the Government should levy an 'environment cess.' The environment cess should be so structured that it increases sharply with the incremental quantum of excess pollution caused.

In West Germany, from the turn of 20th century (1903 onwards), an environment duty is levied on the industries as well as on municipalities. This practice is very successful. Everyone has to pay for the pollution caused by him. Among the developing countries, Malaysia has successfully controlled oil pollution caused by the palm oil industry, one of the biggest foreign exchange earners. The Malaysian government levied a cess on this industry, a small amount in the beginning, on the quantum of oil spilage and gradually increased the cess over a period of about 10 years on those who failed to comply with the reduced limit of oil spillage. The experiment worked. At the end of the specified poeriod, the oil pollution reached an incredibly low level. It was a blessing in disguise too. The industries installed cost-effective equipment to restore the oil spillage and eventually it turned out to be profitable for the industries.

Experience in the western world shows that whenever strict control on industry was exercised by tightening the standards of pollution, industry vociferously protested, but eventually an appropriate technology was invariably developed, so as to keep the pollution low, and which was economically viable. In India, this will surely happen when an environment cess is levied.

The mechanism of the environmental cess has to be very carefully worked out. There cannot be one universal formula for its implementation. The parameters of pollution, namely BOD, COD, pH, oil, hydrocarbons, toxic chemicals, metals etc. vary from one industry to the other. Hence, in each case one or more principal parameters have to be chosen.

Technologies for the measurement of the quantum of pollution have to b devised or improved in as simplifie yet as rugged a manner, as possibl However, this is not an insurmountabl problem and can be developed indigen ously.

The collection of the environmenta cess requires an elaborate organisatio and funds are required for the same. Th central and state pollution contro boards have the necessary basic infra structure. Funds required to run the ces collection set-up can be found. The ces amount will be several times the cost o its collection.

Besides, the industries and municipal bodies can be given soft loans with moratorium for repayments, out of the cess collection. Water cess (1970) may be abolished in lieu of environment cess. The control of pollution can be made more effective by levying an environmental cess, besides the penal provisions prevailing in the various pollution control laws.

MATERIALS RESEARCH CENTRE BEING SET UP IN HYDERABAD

A Centre for Compositional Characterisation of Materials (CCOM) will soon be set up in the nuclear fuel complex campus at Hyderabad. Dr. P.K.Iyengar, Director of the Bhabha Atomic Research Centre (BARC) laid the foundation stone for the centre, estimated to cost Rs. 8 crores, on Sept. 6.

Dr. S. Gangadharan, project-incharge of the CCOM said that the centre, expected to be ready by the end of 1991, would serve as the national facility for validation support of national interest. He said many applications like electronics, space, defence and aviation needed materials and components of high purity and the centre would be able to analyse, detect and quantify the impurities in the bulk on the surface and in depth, and the chemical state information and stoichiometry of major components.

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Highlights in Chemical Technology (Part 2)

NEW FILTER IMPROVES UGAR PROCESSING

An expandable bed fibrous filter orig-ally developed for removing algae, ankton and other particulates from sea ater, has been modified to separate lid impurities from liquid process reams.

It is claimed to have lower labour and aterial costs than conventional filtra-on and lower energy consumption than entrifugation.

The Fibrotex filter developed by Kalsep (UK) can remove micron size articles from a broad range of aque-us process streams — up to 98% of articles down to 2 micron can be taken ut.

The filter element companies a undle of synthetic fibres arranged around a perforated tube and sealed at oth ends. During the service mode, the ibres are twisted, and compressed and he particulate matter is captured by the ibrous bundle as the feedstream flows from the outside of the bundle inwards.

Once the element becomes fully loaded with solids, the fibres are unt-wisted and relaxed ready for cleaning. The particles are removed by backwash-ing the element and 'wringing' the bundle of fibres.

This new unique filter has been tested in a sugar refining process where organic particles encrusted in calcium carbonate are removed from a hot, highly viscous sugar liquor.

The conventional separation device is a centrifugal pre-coat filter; filter-aids incorporated in a coarse cloth serve both to absorb small particles and to ensure that the filter cake has an open structure.

The disadvantages of this method are appreciable quantities of filter-aid are pulled through the fibre cloth and the turbidity of the process liquor is not reduced.

Field trials on Fibrotex have shown that it removes a broad spectrum of particulate matter and significantly reduces turbidity. In addition, the unit does not require filter aids and so there is no contamination of the sugar liquor. (*Processing*, 3/1989, p. 16).

OZONE LAYER VULNERABILITY SPELL NEW RESEARCH OPPORTUNITIES FOR FIBRE GLASS INSULATIONS

Could ozone layer vulnerability spell new life for fibre glass insulations? This question is interesting enough, so much so that the National Institute of Standards & Technology (NIST) has prepared a report 'Technical & Economic analysis of CFC blown insulations and substitutes for residential and commercial construction'.

While the NIST has characterized the polyurethane over extruded polystyrene rigid foam insulation as two of the most efficient insulating products, it says both contain chlorofluorocarbons (CFCs). The CFCs are used in the manufacture of gas cells that make it an excellent insulator.

But the manufacture of CFCs may be curtailed due to ozone threats, so the NIST researchers, looked into the cost effectiveness and potential energy consequences of using expanded polystyrene and good old fibre glass which does not contain CFCs. The NIST researchers conclude: both insulation materials typically cost less than most CFC - containing foams.

But the catch is, because they have air bubbles instead of gas bubbles, they do not insulate as efficiently. Hence more of the material is needed to achieve the same thermal performance, resulting in an increase in cost. Perhaps, further research can alter this situation bringing new opportunities for fibre glass insulator. (*Am Glass Rev.*, 12/1988, p. 4).

A PRODUCTION SCALE SUPERCONDUCTING-THIN-FILM MACHINE — THE WORLD'S FIRST

A production scale superconducting, thin film machine — the world's first was delivered last June, to Du Pont superconductivity — Concept Centre (Wilmington, Del, USA). The unit, the System 5000, was built by Emcore Corpn., (Somerset, N.J.), a supplier of technology and equipment for chemical vapour deposition (CUD), chemical beam epitaxy (CBE) and other thin film processes for microelectronics and advanced materials fabrication.

'Production scale means that the machine is guranteed to produce thin films of given purity levels, and to work on multiple 2,3 or 4 in. wafers at a time' reports Emcore. Among the highlights of the Emcore CUD machine is a rapidly spinning (up to 2000 npm) platter that holds the silicon wafers from which integrated circuits are made.

The spinning allows for the production of monomolecular layers having compositions and structures within 99% of specifications. Tests have confirmed the onset of superconductivity at temperatures of 60-95K in yttrium-barium-copper mixtures made by the system 5000. (*Chem Engg.*, 5/1989, p.p. 19-21)

A FUEL CELL DEVELOPED TO SYNTHESIZE ACETALDEHYDE

Chemical engineers in Japan have indegenously designed a fuel cell to synthesize acetaldehyde and produce electricity at the same time. Kiyoshi Otsuka and his collegues at the Tokyo Institute of Technology have devised a fuel cell to generate acetaldehyde — an important start in industrial chemistry.

The fuel cell produces electricity from two cheap raw materials ethylene and oxygen. This electrochemical process is much safer than the conventional methods of producing acetaldehyde. One of the most common of today's methods is known as Wacker process.

This involves the controlled oxidation of ethylene in a solution containing a catalyst made of palladium and copper chlorides. It is a mild process that is efficient and works well at ambient temperatures.

Unfortunately the Wacker process has several disadvantages. The process takes place in water, in which acetaldehyde is highly soluble. This means that acetaldehyde must be separated out by distillation — an additional cost.

Also, the catalytic solution of palladium and copper chlorides is corrosive, causing wear and tear on chemical plant. But the biggest problem is that the mixture of ethylene and oxygen can be highly explosive. The Otsuka fuel cell process is reported to solve all these handicaps.

Fuel cell works much like ordinary batteries, except that their ingredients are continuously supplied from outside and the products continuously removed. Unlike in ordinary battery a fuel cell can operate at close to its maximum efficiency as long as fuel is supplied.

The electrolyte in a fuel cell is usually concentrated acid or alkali, while the electrodes are made of a precious metal, such as Pd, Pt or Ni. The most common fuel is hydrogen, but the cells can use other fuels, such as hydrazine, hydrocarbons and alcohols.

Ethylene is an extremely reactive industrial chemical and is also readily available from the cracking of cheap petroleum. So Otsuka research team tried ethylene as the fuel in a conventional fuel cell.

Otsuka's electrochemical cell consists of two compartments separated by a plug of silica wool soaked in the electrolyte concentrated phosphoric acid. On either side of the plug is an electrode made of powdered palladium. On its own powdered palladium will not convert ethylene and oxygen into acetaldehyde.

But if the chemical engineers add a mixture of ethylene and a little water vapour with helium gas to the left compartment and oxygen to the right compartment, a current will flow and the cell can produce acetaldehyde on the left electrodes.

Otsuka and his colleagues explain that as the cell works cautions of Pd are formed at the interface of the palladium electrode and phosphoric acid, these react with ethylene and water to make acetaldehyde and hydrogen ions. The hydrogen ions migrate across the plug of silica wool to the other electrode, where they react with oxygen to form water.

The ethylene and oxygen are kept apart so there is less risk of an explosion. The process also produces its two products at separate electrodes, so there is no need to distil out the acetaldehyde.

The Otsuka research group was keenly interested in fuel cell and acetaldehyde synthesis, but the main impetus behind their above research breakthrough was the need to produce acetaldehyde safely. They claim tha their electrochemical process carries n risk of explosion.

The Japanese research team is stil testing the system on pilot plant scal and sees no problem in the actual devel opment towards commercialization. The idea of synthesizing acetaldehyde from a fuel cell producing electricity, has proved a real breakthrough in the elec trochemical production of organic chemicals. (*New Sci.*, 2/11/89, p. 40)

A BONE SUBSTITUTE BASED ON CERAMIC

A new ceramic which is stronger than human bone could soon be available in Japan, thanks to Japanese researchers. The ceramic is 'bioactive' and so binds with human bone. No other existing bioactive material is stronger than bone.

The new ceramic apatite — wollastonit glass (A/W Glass) is made from Calcium phosphorus and silicon powder. It can be cut or moulded into any shape such as vertebra.

In the USA, scientists must have approval from the FDA, before trials can be conducted on humans, but Japanese researchers need only the permission of the patient.

Takao Yamamuro, head of orthopaedic surgery at Kyoto University, reports that nearly 200 bone surgery patients have successfully been treated in trials with ceramic bone since 1982. Yamamuro hopes that the Japanese Government will soon approve the new glass material for use throughout the country.

Yamamuro's first patient was a 50 year old woman, who had breast cancer, which spread to her spine, fracturing it and leaving her legs paralysed. Surgeons removed the tumour and replaced two-and-a-half vertebra with the new

ramic. Normally, surgeons would be le to replace the part of the spine moved with the tumour with the tient's own hip bone, but in this case at bone had also been affected by ncer.

Six years on she is still doing well, nd can walk, said Yamamuro. Where rength is not required, such as when bone cyst is removed leaving a small ole, the glass can be packed in the efect with fibrin, a protein that ncourages bone to regenerate. (*New ci.*, 5/27/89, p. 43).

WORLD'S MOST ACCURATE PRECISION WELDING BY ROBOTICS UNVEILED

A robotics company in Britain claims to have performed the world's most accurate weld, as part of the programme to build Europe's Ariane-5 family of Space Rockets.

Meta machines of Oxford has unveiled a robot system which it reports can weld at least 10-times as precisely as its human counterpart. It has used the system to weld hundreds of tubes together to form an exhaust nozzle for an Ariaine-5 rocket. Each tube is 3 metre long with a diameter of 4 mm. The tubes have a square cross section and very thin walls.

This was the first time that anyone has used a robot with a direct drive — that is one with no gears between the motor and arm itself — for welding. Direct drive robots are far smoother and more accurate than geared systems.

This combined direct drive robot with its own sensor, combines a laser and a solid state camera in one unit. This is known as Meta Torch and allows the welding head to track its way along the seam ahead.

Meta Torch scans the path ahead between 10 and 20 times every second. It monitors errors in the position of the robot relative to the centre-line of the seam, and variations in the gap between adjacent tubes.

The sensor achieves this by shining a razor-thin sheet of light from a laser onto the joint first ahead. Light is reflected back from the joint to the solid state camera. Software then analyses the images from the camera to work out the best position for the robot.

Peter Davey, who founded Meta Machines in 1984, says that the most important of the welding system is the software which controls the device. This allows the welder to position the tungsten tip with an accuracy of 0.015 mm. Such accuracy is critical to the system: tungsten tips have to be replaced as often as once an hour because they are eroded by the welding process.

After the operator has replaced the tungsten tip, the system recalibrates itself to accomodate the new tip. (*New Sci.*, 1/21/89, p. 38).

NYLON MAY WORK IN MOVING ENGINEERING PARTS

Nylon's inferior dimensional stability had eliminated nylon-based materials for use in applications such as gears, cans, bearings and other moving parts. Now Akzo Engineering Plastics (Evansville IN), a subsidiary of Akzo, has developed a process that may allow nylon and other crystal polymers to be used to replace metals in moving parts.

The new materials I-77/30/TF/15 and I-71/30/TF/15, are produced by combining base resins with 30% by weight short fiberglass and a 15% weight loading of polytetrafluoroethylene (PTFE).

Akzo reports the result is speciality materials that display a low coefficient of frictions, reduced wear resistance, high flexural modulus, high temperature resistance and ease of processing, as well as dimensional stability. Akzo further cites weight savings, noise reduction and corrosion resistance as advantages of the new materials. (*Chem Wk.*, 5/3/89, p. 32).

DIMETHYL ETHER'S USE AS AEROSOL PROPELLANT TO BE EXPLOITED BY AKZO

Dimethyl ether (DME) can be effectively used as an aerosol propellant to replace chlorofluorocarbons (CFCs). Therefore, there is a great potential for greater demand. Akzo (W.Germany), therefore, has decided to produce DME at its plant in Rotterdam (Holland).

The Company plans to produce 25,000 tons/yr. of DME to capture the large European market potential for aerosol products. CFCs are due for phase out in Europe by the end of 1991. (*Chem Wk.*, 5/3/89, p. 13).

MINIATURIZED MAGNETOMETER BASED ON HIGH TEMPERATURE SUPERCONDUCTORS ON THE HORIZON

Researchers at IBM are now close to making detectors based on high temperature superconductors for measuring minute measuring fields. These devices known as SQUIDS (Superconducting Quantum Interference Devices) can measure magnetic fields as small as one billionth that of the Earth.

Scientists can exploit them to design magnetometers sensitive enough to measure the magnetic field given off by the brain and heart.

Hospitals already use such devices to diagnose brain and heart problems, but their current machines use low-temperature conductors operating at just over 4 Kelvin. These devices are kept cool by liquid helium.

This makes the devices bulky because of the insulation required to keep the devices cool. IBM's Roger Koch recently announced the development of a SQUID made from a hight tempera-

ture superconductor which operates at 77 Kelvin. This means the device could be kept cool with liquid nitrogen, and would therefore need less insulation, making it less bulky.

This development should enable scientists to miniaturize sensitive magnetometers to the size of a fist. This will make possible diagnosis in the doctors office instead of slow-going hospital procedure.

The magnetometers can also be used to detect the very small magnetic field of rocks. Because the Earth's magnetic field has changed over the years, geologists can use SQUIDS to date back rock formations.

Scientists have developed SQUIDS from high temperature superconductors in the past, but the changes in magnetic field generated by the superconductor swamped the external signals that the SQUIDS were trying to detect. This internal noise results from the thermal energy of the superconductor itself.

The researcher Koch therefore, decided to use superconductors based on thallium. He found that although these materials are just as noisy as other high temperature superconductors, they are much more sensitive to the external signals that they are supposed to detect.

Recently, Koch reported that his thallium based SQUIDS are a thousand-times better at detecting magnetic fields than a SQUID made from other high temperature superconductors. This makes them good enough to be used in commercial devices.

So far Koch has not managed to wrap his SQUIDS in a coil which would carry signals from the outside world to the SQUID itself. However, according to him this is a simple manufacturing problem, which can be solved early. He is confident of having a demonstration of working SQUIDS within two years (*New Sci.*, 4/1/89, p [illegible]).

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cope for setting up mini cement plants in the North Eastern Region

P. Barkakati & U.C. Borah*

stract

Cement being in short supply and more particularly in the rth Eastern region deserves special attention in utilising smaller seposits of limestone available in the region. The ality of these deposits are compared with the quality quirement for the Vertical Shaft Kiln technology of cement nufacture. Depending on the present position of the ment Industry in the North Eastern region, and the demand d supply of cement, the possibility of setting up small scale ment plants using RRL Jorhat VSK technology are dis-ssed. The advantages of setting up tiny cement plants in e small scale sector are also discussed in the paper.

Portland cement is used in all construction activities. The mand for cement has been consistently higher than the pro-uction. During 1984-85 the production of cement in India as 30.17 million tonnes against an installed capacity of 40.72 illion tonnes, thus achieving a capacity utilisation of 74.1%. 1985-86 the total demand in the country was 39.4 million tonnes whereas the production was 33.1 million tonnes, thus creating a shortfall of 15%.

The working group of planning commission has envisaged a production of 49 million tonnes of cement against an installed capacity of 62 million tonnes by the end of the Seventh Plan period during 1989-90.

Production achieved during 1986-87 was 36.4 million tonnes. For 1987-88 the target production was 42.5 m. tonnes.

As far as Assam is concerned the demand in 1984-85 was 1 million tonne and during 1989-90 the demand is projected at 1.3 million tonnes. The present capacity of the only major cement plant in Assam is that of Cement Corporation of India's plant at Bokajan with 0.2 million tonnes per annum capacity. In the North Eastern region presently there are four cement plants in production.

Name of Plant	Process	Installed Capacity	Location	Year of commissioning
(1)	(2)	(3)	(4)	(5)
Mawluh Cherra Cements	Wet, rotary	0.286 m tpa	Cherapunji	1966
Cement Corporation of India	Dry, rotary	0.200 m tpa	Bokajan, Assam.	1977
Parashuram Cements	VSK	30 tpd	Tezu, Arunachal Pradesh	1984
North East Cements	VSK	100 tpd	Umrangshu, Assam	1988
Plants under implementation				
Nirag Shiva Cements	VSK	25 tpd	Kamakuchi, Guwahati, Assam.	-
Udayana Cement	VSK	25 tpd	Lanka, Nagaon, Assam.	-
Byan Industrial House (P) Ltd.	VSK	25 tpd	Dimapur, Nagaland	-
Nagaland Govt. Plant	VSK	100 tpd	Nimi, Nagaland	-
Virgo Cements	VSK	100 tpd	Garo Hills, Meghalaya	-
Arunachal Govt. Plant	VSK	50 tpd	Epaipani, Arunachal Pradesh	-
North Eastern Council	VSK	50 tpd	Hungdung, Manipur	-
North Eastern Council	VSK	50 tpd	Wezeho, Nagaland.	

Shri. P. Barkakati and Shri U.C. Borah are Scientists in the Regional Research Laboratory, Jorhat - 785 006 (Assam).

(1)	(2)	(3)	(4)	(5)
Vinay Cement	Rotary	200 tpd	North Cacher Hills, Assam.	-
Umrangshu Cement	VSK	100 tpd	Umrangshu, Assam	-
Jayantia Cement Ltd.	VSK	100 tpd	Jowai, Meghalaya	-
Bomber Cements	VSK	25 tpd	Borapani, Meghalaya	-
Karbi Anglong Chemicals	VSK	25 tpd	Diphu, Assam.	-

Numerous small deposits of limestone are available in the North Eastern region. The quality of these deposits in most of the cases are suitable for cement making. Cement being in short supply and more particularly in the North Eastern region deserves special attention in utilising these small deposits of cement grade limestone. The setting up of small VSK plants will overcome the transportation bottleneck through our already strained transportation system.

A few limestone deposits of the N.E. region with approximate reserves and average lime content are tabulated in table 2. The lime content indicates that these deposits will be suitable for cement making but the extent of deposits in certain cases is small to warrant setting up of conventional large rotary kiln plants. Moreover, the difficulties of transportation over long distance and hazardous terrain, obstruct the raw materials transportation to any centralized large scale plant as well as distribution of its products.

Transportation of cement to border and forward areas and the hill districts of North Eastern region with difficult transportation system also makes the delivered cost of cement highly prohibitive. It is therefore advantageous to set up small shaft kiln plants of 20 to 100 tpd suiting the need of the locality and utilizing the available local resources.

Research and development works conducted in RRL Jorhat, a constituent laboratory of the Council of Scientific & Industrial Research, revealed the feasibility and economic viability of shaft kiln plant for production of cement. RRL Jorhat started work on designing VSK since 1964 and the first Indian patent on VSK design was filed in 1967 with subsequent revisions filed in the later years. The process was released through National Research Development Corporation, New Delhi and the first licence was given to M/s. Kutch Cement Pvt. Ltd. in 1976.

The 30 tpd plant went into successful commercial production in 1980. The present capacity of the plant is 60 tpd. At present there are 19 RRL Jorhat VSK plants in commercial operation in different parts of the country and 18 more projects are in different stages of implementation.

The Process:

The process involves pulverising a well proportioned material viz. limestone, clay, low reactive coke breeze corrective materials if any to a fineness of at least 90% sing through 170 BSS. The pulverised raw meal is then ho ogenised in a pneumatic blender with compressed air. raw meal is then nodulised in a pan type noduliser with help of water spray. The nodules of about 6-10 mm meter and moisture content 10-12% are then fed into the drying zone of the shaft kiln.

The shaft kiln consists of a long vertical cylindrical s at the bottom and a conical sintering zone lined with refi tory materials at the top. A rotary discharge grate at bottom of the cylindrical shell, coupled with its drive ta care of uniform discharge of the clinkers from the kiln. inbuilt design of the rotary grate permits uniform mate movement and distribution of air through the entire len and breadth of the kiln supplied from a positive pressure ro blower.

The green nodules fed into the kiln predrying zone s their passage downwards as the hot flue gas of increas temperature flows counter current to the nodules flow. In successive increasing temperature of the conical zone, nodules are initially dried, dehydrated, calcined and fi the oxides recombine to form the essential cementing pha The sintered nodules or cement clinkers thus formed du their further passage downwards, encounter air flow decreasing temperature, get cooled and finally make their through the periphery of the rotary discharge grate and air lock discharge system. Once the kiln is lighted no a tional fuel is required besides what is incorporated in the meal in the form of coke powder.

The cement clinkers thus obtained are then pulverised admixing with required amount of gypsum in a cement to a Blaines fineness of around 3000 $cm^2/gm.$, fin packed in bags weighing 50 kg each and marketed.

The finished product conforms to the Indian standard cification laid down in IS:269-1976 for ordinary port cement

The specification of raw materials required for producing ment using RRL Jorhat VSK is presented in Table 1.

Considering the prevailing conditions in the North East- n Region, the cost of production per tonne of cement in 25 tpd RRL VSK tiny cement plant works out to around s. 1200/- per tonne, whereas the present ruling price of free le cement in Assam is more than Rs. 1700/- per tonne. ecent R & D effort of RRL Jorhat has also indicated that ssam coal can be used as a fuel for making quality cement the VSK process. Successful implementation of this R & effort is likely to further bring down the cost of produc- on. Thus the mini cement industry appears to be quite attrac- ve in the small scale industrial sector. The technology being ry simple also does not require high level technical exper- se for operation and can provide employment to about 50 ersons directly and to another 100 persons indirectly. The tal project cost of a 25 tpd tiny VSK unit is around Rs. 95 khs and the cost of plant & machinery being within Rs. 35 khs, the project falls under the SSI limit. Moreover, North astern region being industrialy backward, Govt. has given number of incentives for encouraging industrial develop- ent in the region. Some of them are:

) Central Govt. subsidy upto the extent of 25% of total fixed capital investment.
) Seed capital assistance.
) State Govt. equity participation.
) Transport subsidy for raw materials.
) Power subsidy.
) Moratorium on sale tax.
) Investment allowance.
) Subsidy on stand-by power generating set.
) Concession on central excise.

Table 1

aw material specification for producing cement using RRL Jorhat vertical shaft kiln

imestone		
ao	% min.	45.0
O_2	% max.	12.0
l_2O_3	% max.	4.0
e_2O_3	%	2.0 to 4.0
gO	% max.	2.0
lay/Flyash/Shale		
O_2	%	60.0 to 66.0
l_2O_3	%	12.0 to 18.0
e_2O_3	%	5.0 to 9.0
oke Breeze		
alorific value,	Kcal/kg	6000 min.
ish	% min.	30.0
.M.	% max.	8.0
ypsum		
aSo_4	purity 80%	
I_2O		

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Table 2

A few limesstone deposits in North Eastern region*

Location	Approximate reserve in million tonnes	Average % CaO conte
Assam		
Koliajan, Dilai Parbat (Karbi Anglong)	30	49.72
Samilangso	0.626	43.0
Sheel Bhetta	2.0	45-52.3
Panimur		No economic importanc
Garampani	20.6	47.86
Umrangshu, 11 km Post	6.4	47.42
Umrangshu, 16 km Post	26.7	46.24
Nagaland		
Nimi (Twenchung)	3.75	47-53.5
Wezeho (Phok)	1.5	46.8-54.8
Arunachal Pradesh		
Tidding	140	45
Tezu (Lohit)	73.8	marble
Kabbu (Siang)	1.49	Carbonates suitable for
Dali (Siang)	225.5	kiln.
Manipur		
Ukhrul (Band I)	5.79	43.18
Ukhrul (Band II)		44.7
Hungdung South	0.17	44.66-54.66
Hungdung North	1.77	41.46-51.95
Khanggoi	0.26	47.74
Nova	0.045	50.65
Meghalaya		
Lamgaon-Therriagat	Total	49-52
Sheila-Mawsynram	900	
Kunmerash	3.5	54
Lakadang (Mawluh)	40	54
Lumshong		
Mynkre	-	54
Khaddum		
Syndai	-	45.3-52
Sutnaga	-	48-53
Nonkhlish	-	53
Siju Ardeka (Garo Hills)		
Siju Songmong (Garo Hills)	50.82	

Occurence in Tripura and Mizoram are in very small quantity.

* Data taken from (a) Miscellaneous publication No. 1, October 1982, Directorate of Geology & Mining, Govt. of A
(b) Miscellaneous publication No. 30, December 1974, Geological Survey of India

Genetic Recombination

Mr. A.K. Das

Industrial Adviser (Chem.) DGTD.

Biotechnologies consist of using bacteria, yeasts and animal and plants cell cultures of which the metabolism and bio-synthetic capacity are geared towards the manufacture of specific substances.

Bio-technologies make it possible through an integrated application of knowledge and techniques by bio-chemistry, micro-biology, genetics and chemical engineering, to draw benefit at the technology level, from the properties and capacities of micro-organisms and cell cultures.

They offer the possibility of producing from widely available renewable resources, substances and compounds essential to life and the greater well-being of man. Bio-technology seems to have attracted more public and commercial interest than any other emerging technology except perhaps super conductor and microchip.

Genetic engineering is the latest development in biotechnology and is a very new discipline in this age of fast-developing technology. Discovered relatively late in recent years, it has already given birth to more than 400 companies worldwide. Investment in the United States alone is estimated at some US $ 3 billion.

The promises held out by genetic engineering include cures for cancer, diabetes and even ageing. United Nations Industrial and Development Organisation have already been instrumental in initiating an International Centre for Genetic Engineering and Biotechnology at Triest in Italy and New Delhi in India.

Genetic recombination consists of exchange of genes between two chromosomes. Recombination is defined as any process capable of giving birth to cells or individuals in which two or more hereditary determinants, by which their former parents differed, are associated in a new way. Such recombination is compulsory in mammals when sex cells are produced.

Genetic recombination is less frequent among viruses and bacteria than animals. Deoxyribonucleic (desoxyribosonucleic) acid, DNA are long thread-like molecules found in chromosomes and some viruses, consisting of two interwound helical chains of polynucleotides.

The sugar of all the nucleotides is 2-deoxy-D-ribose, but such nucleotide is characterized by one of the four following nitrogenous bases: adenine, cytosine, quanine, and thymine. DNA molecules are responsible for storing the genetic code by the order of the arrangement of their nitrogeneous bases, three bases coding for one amino acid.

The structure of a DNA molecule has been like a twisted rope-ladder, the sides of which consist of sugarphosphate chains, the rungs of linked nitrogenous bases. The rungs consist of complementary base pairs linked by hydrogen bonds.

The bacterial chromosome is a 1-millimetre DNA molecule of some 3 million nucleotides, folded back and forth several thousand times into a space less than a micron across. In human cells, DNA is packed into forty-six chromosomes, each one containing a DNA molecule and the total amount of nucleotides corresponds to about 3 billion nucleotides.

The restriction ends nucleases cup up the molecule of DNA at particular points and break it up into pieces, from a few hundred to a few thousand nucleotides long, which can be isolated by length. Some 400 restriction enzymes are known, each of which has its specific mode of cleavage of DNA.

Exchange of genes cells introduction into a cell of a gene belonging to another species can be done through **INVITRO** gentic recombination. Such a technique has been applied to bacteria, in particular the Colon Gascillus, where genes of animals and human cells have been introduced and propagated.

INVITRO recombination techniques comprise the extraction of DNA from different species, the making of a hybric DNA molecule and the re-introduction of the recombinan molecule in a living cell in order to obtain the expressio of a new character.

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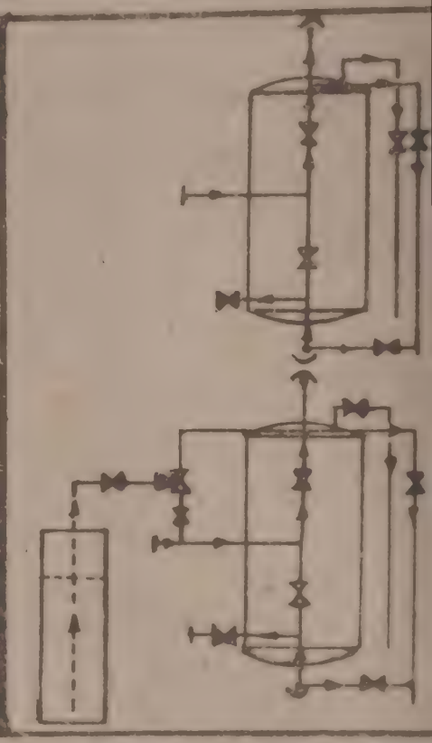

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MATERIALS MANAGEMENT
Part VIII - Inventory and its Control (Contd.)

N.R. PAI

In the previous communication published in *CHEMICAL WEEKLY* dated 15.8.1989, we have noted that the trial and error method is not only tedious and time consuming but by this approach we may fail to arrive at the least possible total cost which is made up of ordering cost plus carrying cost. Hence EOQ formula is developed to arrive quickly at the correct and accurate decision.

EOQ (Economic Order Quantity) Model

It has been observed that when a graph is drawn for different values of (Q) quantity per each order against cost, with,

1. Q on the X axis
   and
2. Cost in Rs. on Y axis

as shown in the Figure 1 herebelow, an exponential function graph I is obtained for ordering cost (A/Q x c) while a linear function (graph II) is arrived at to represent carrying cost given by (Q/2 x PE). The third graph representing total cost (graph III) is then drawn, the points for which are obtained from algebraic sum of the Y coordinates of the other two graphs for a given X coordinate.

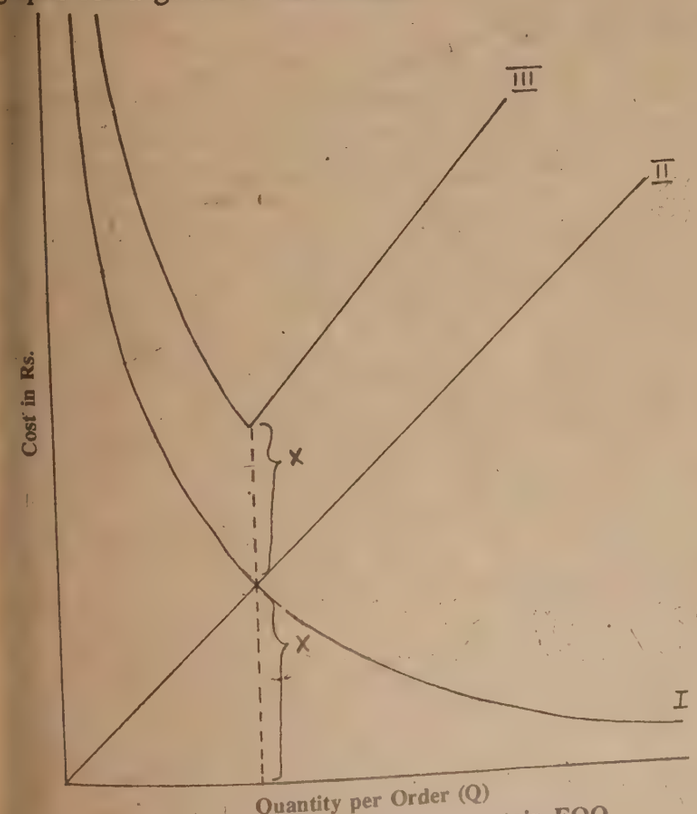

Fig. I. Graphic method to ascertain EOQ

Graph I - Ordering cost = A/Q x C
Graph II - Carrying cost = Q/2 x PE
Graph III - Total cost = Ordering + Carrying Cost.

Points for which denotations stand are repeated here below for the convenience of the readers:

A = Annual fixed demand
C = Cost per order
P = Price of each item
E = Carrying cost expressed as percentage of P
Or = A/Q = Number of orders per year, where Q is the quantity per order.

Fig. I clearly shows that the minimum total cost position on the IIIrd graph lies just above the point of intersection of the other two graphs, representing ordering cost and carrying cost. It can be therefore concluded that total cost is minimum when ordering cost = carrying cost. This fact is made use of in developing EOQ model. It is worth noting that a perpendicular dropped from the point representing the least cost on the IIIrd graph to the X axis will directly read the value of EOQ, often written as QECO, provided the graphs are drawn accurately.

To develop EOQ model we then equate ordering cost and carrying cost and proceed as follows:

Carrying cost = Ordering cost

$$Q/2 \times PE = A/Q \times C$$
$$Q \times PE = 2AC/Q$$
$$Q^2 = 2AC/PE$$

Hence $QECO = \sqrt{2AC/PE}$

The last equation is the formula to work out economic order quantity and our problem given in the earlier communication [*C.W.*, 15.8.1989 (where, A = 3000, C = 60, P = 20 and E = 20%)] can be quickly solved with its help, first by substituting the values, as shown below:

$$QECO = \sqrt{2AC/PE}$$
$$= \sqrt{\frac{2 \times 3000 \times 60}{20 \times 20/100}}$$
$$= \sqrt{36000/4} = \sqrt{90000} = 300.$$

Hence quantity per order suggested by EOQ formula is 300. Since the total annual demand for the item is 3000, the number of orders to be placed will then work out to:

3000/300 = 10 = Or

We can now proceed to calculate total cost as follows:

Ordering Cost = Or x C
= 10 x 60
= 600

while,
Carrying Cost = Q/2 x PE
= 300/2 x 20 x 20/100
= 150 x 4 = 600

The total cost is then given by:
Rs. 600 + Rs. 600 = Rs. 1,200.00

Review of the trial and error method (*C.W.* 15.8.89) indicates that we have missed this point of:
QECO = 300

The least cost shown there, was Rs. 1,300.00 against Q = 200. Again this figure was arrived at in a sluggish and cumbersome manner. There is one more point to be noted. If in drawing the graph "number of orders" is shown on X axis instead of "quantity per order", then we get a linear function whereas ordering cost and carrying cost comes out as an exponential function as indicated in Figure II below:

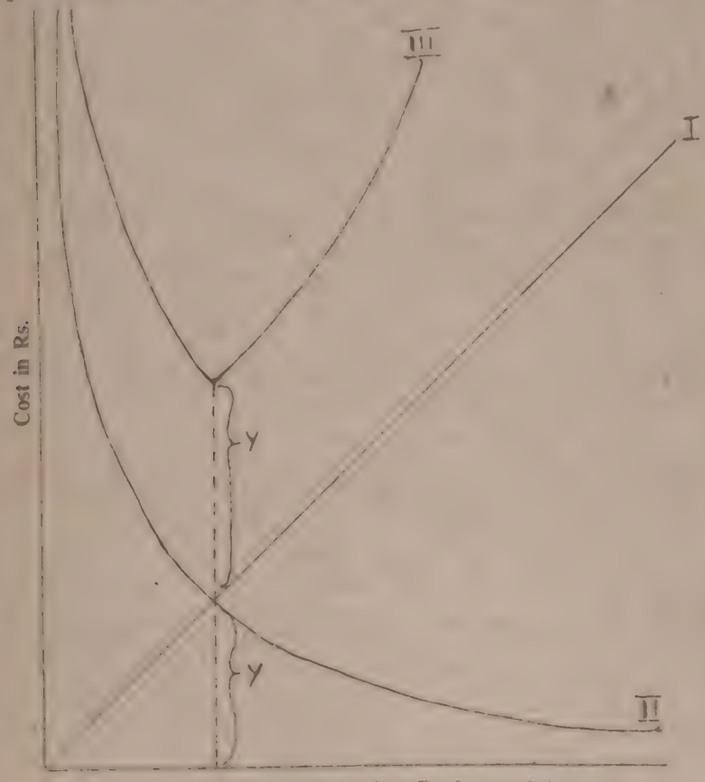

Fig II. Graphic method to get optimum number of orders corresponding to EOQ

Graph I = Ordering Cost
Graph II = Carrying Cost
Graph III = Total Cost.

We have already noted in our previous communication (*C.W.* 15.8.89) that every mathematical model employed in management technique has three aspects in common; it has assumptions, logic and drawbacks. We have gone through the first two aspects. Now we have come to shortcomings of EOQ, the third aspect.

Shortcomings of EOQ

i) Accuracy is not possible to work out ordering cost a carrying cost. The points (factors) which go to build t these costs are difficult to calculate e.g. cost incurred beca of the time spent by the executives from other departme who are on tender committees or time spent by accounts s for purchase departments work.

ii) EOQ figure is arrived at with the help of a mathem ical formula. Often one gets it in fractions. Then it is not o an inconvenient number but an impractical number t Again, the ordering interval suggested by EOQ is often inc venient and impractical. Human judgement is theref needed to rectify this weakness (See Example-I below)

iii) There is no consideration of market position in c culating EOQ. If the prices are declining then one may b raw material unnecessarily at higher price by referring EOQ.

iv) EOQ does not take into account lowering of raw ma ial demand. If the demand for raw material is declining, adh ing to EOQ figure is bound to step up obsolescence. T situation highly detrimental to companys growth or ever its very existence.

v) EOQ may not turn out to be profitable if advanta by way of quantity discounts is substantial. Advantage quantity discount often outweighs that by EOQ as shown Example II.

It is worth noting that mathematical models in mana ment do not always furnish results that are 100% workab Like other models EOQ also has limitations and shortco ings which are discussed above. These should be taken i account during its application. Only then will there be a p fitable outcome, and this is exactly where the human jud ment figures in.

Example I

This example illustrates two aspects of EOQ; one is a p itive aspect while the other is a negative one. The posit aspect indicates that EOQ is capable of taking care of changes in demand of the items during a year.

The negative point brings out the shortcomings of EO It shows that the application of EOQ model generally gi you a figure which is in fractions and which is therefore inconvenient number for all practical purposes. Hur judgement is then needed to arrive at the practical and c venient figure close to that suggested by EOQ.

Consider an organisation with the following data:

Demand for a particular item for the first 9 months (January to September) of the year = 1200 items.

Demand for the same item for the last 3 months of the year (Oct. to Dec.) = 2000 items (peak period).

) C = Cost per order = Rs. 70/-

) P = Price of each unit = Rs. 40/- and

) E = Managements estimate of annual carrying cost expressed as percentage of P = 20.

Let us take the first case where A = Demand per given eriod (here, 9 months) = 1200 items.

low, we have,

$$QECO = \sqrt{2AC/PE}$$

y substituting the values, we get:

$$QECO = \sqrt{\frac{2 \times 1200 \times 70}{40 \times 20/100 \times 9/12}}$$

Since period in question is of 9 months the denominator should be multiplied by 9/12).

On solving we get,

$$QECO \quad \sqrt{28000} \quad = \quad 167.33$$

However, 167.33 is an inconvenient number. The convenient figure close to it is 150. Now, if 150 items is the quantity per order then number of orders for the first 9 months will be given by

$$\frac{\text{Total demand for first 9 months}}{\text{Quantity per order}} = \frac{1200}{150} = 8 \text{ Orders}$$

Hence for the Jan-Sept. period, 8 orders, each of 150 items would serve the purpose.

On the same lines EOQ can be calculated for the Oct-Dec. period and then convenient number closest to this figure suggested by EOQ can be fixed with the human judgement.

Here, A = 2000. C, P and E will have the same values as before only denominator has to be multiplied by 3/12 since here period is of 3 months.

So, we have,

$$QECO = \sqrt{2AC/PE}$$

$$= \sqrt{\frac{2 \times 2000 \times 70}{40 \times 20/100 \times 3/12}}$$

$$= \sqrt{140000} \quad = \quad 374.16.$$

The convenient number close to 374.16 is 400. With EOQ = 400, number of orders would be:

2000/400 = 5.

Hence for Oct-Dec. period 5 orders each of 400 items would suffice.

Example II

Often the advantages by way of quantity discounts outweighs that by EOQ. It can be illustrated by the following concrete example.

Consider a concern with the following data:

i) Annual demand for an item = 5000 units
ii) Discount offered by the vendor for bulk purchases of 2000 units and above = 12%
iii) Price of each unit = Rs. 100/-
iv) Inventory carrying cost is 25% and
v) EOQ application points out quarterly purchase of 1000 units.

Then, sticking to the figure dictated by EOQ we have,
Average inventory = 1000/2 = 500
Cost of 500 units - Rs. 50000/-
Inventory carrying cost 25%
= 25/100 x 50000/1 = Rs. 12500/-

Now,
To avial of quantity discount we can make two purchases each of 2500 units every 6 months. Then the average inventory - 2500/2 = 1250 units.

Cost of these 1250 units (Rs. 100 per unit) = Rs. 125000/-
Its carrying cost at the rate of 25%
= 125000/100 x 25/1 = Rs. 31250/-
Loss incurred by way of carrying cost in this 2nd method as compared to 1st method is:
Rs. 31250 - Rs. 12500 = Rs. 18700/-

Now, the cost saving in this 2nd method by way of 12% quantity discount for yearly purchase of 5000 units will be given by:

5000 x 100 x 12/100 = Rs. 60,000 (Rs. 100 being price of each unit)

Hence net advantage by availing of the offered quantity discount and ignoring the figure suggested by EOQ is:
Rs. 60,000 - Rs. 18750 = Rs. 41250/-

All the above examples we have solved with the knowledge of ordering cost and carrying cost. These two costs can be calculated in their turn from the information obtained, for example, under the following heads:

1. Value of average annual inventory.
2. Number of orders per year
3. Purchase departments salary and utility (lights, fans etc.)

4. Expenses due to stationery usage, telephones, telegrams, telex, etc.
5. Expenses due to material handling on order receipt.
6. Cost due to spot inspection of materials on receipt.
7. Expenditure incurred by other departments (e.g. by way of time spent by persons from other departments sitting on tender committee).
8. Any other head under which ordering cost creeps in.
9. Salaries of persons working in stores/inventory section.
10. Expenses by way of obsolescence, material spoilage or material deterioration due to storage beyond shelf-life.
11. Stores rent, and expenses due to usage of lights, fans, air-conditioners, refrigerators, etc.
12. Salaries of security personnel involved in protecting stores.
13. Interest on the money blocked in inventory.
14. Cost of insuring goods.
15. Any other point related to carrying cost.
16. Total annual demand of the item.
17. Price of each item.

Sum of all the expenses shown under the points (3) to (8) gives total cost of orders placed in an year. Dividing this figure by number of orders per year (2) furnishes ordering cost (C), it is in fact average cost per order.

From points (9) to (15) carrying cost can be calculated. The sum of the expenses covered under these points is shown as the percentage of average annual inventory i.e. of point (1) which is our carrying cost (E) to calculate EOQ.

EOQ can then be calculated by applying the usual formula, values for A and P being known, which are given here under points (16) and (17) respectively.

Pareto's Findings

Pareto was a Prussian economist. He was working on distribution of incomes in Prussia. He found out that lot of disparity prevailed in the income distribution. His findings are embodied in what is known as Pareto's Law, which states that 20% of the people got 80% of the money and conversely 80% of the population earned 20% of the wealth. But the most wonderful fact is this Pareto's findings were used in several fields barring the welfare economics for which it was really meant. A-B-C classification is one of the classic examples of its application. This classification is used in selective inventory control.

SELECTIVE INVENTORY CONTROL

1. A-B-C Classification

Materials management is concerned with a number of individual transactions every year. Several items are involved in these transactions. To carry out his work efficiently, ma ials manager must concentrate on important items only, av ing distraction of his mind on insignificant details.

Normally any enterprise has multi-item inventories. Th are several items to be stocked. They include for exam raw materials, machine spares, machine accessories etc glance at their usage rate would clearly reveal that items raw materials have high usage rate and have therefore h demand, while machine spares and machine accessories h relatively a much low usage rate and hence low demand. M of the inventory investment therefore, is in terms of a items like raw materials with high demand. It therefore ne careful attention of the manager for its effective control. the other hand most of the items have low demand, they bl little funds and can therefore be controlled in a rou manner. They therefore occupy a secondary position in inv tory control system.

With reference to Pareto's Law we can say that 20% the items, from the stocks maintained by an organisati account for 80% of investment in inventory; while 80% the items, which are comparitively less important inve ment wise block 20% of the inventory funds. This law d hold good in case of every industry. Only the percenta mentioned may vary depending upon the kind of invent and the type of industry. It is therefore quite obvious t items with high inventory involvement should be trea separately from those in which comparatively insignific funds are blocked. One such approach is then to segreg the entire stocks of an organisation as per what is known A-B-C classification.

Accordingly ***Class A*** will have a less number of items, top 10%, which have high usage rate, hence high dem and therefore in turn, they involve high investment Rup wise.

Class-B will include middle, say 25% of the items v moderate usage rate, moderate demand and hence mode investment.

The last ***Class C*** will carry the huge number of the rem ing stock-keeping items with low usage, demand and inv ment. They stand for a small fraction of total invent investment.

Objective of ABC classification

It aims at separating out from the rest, the Class 'C' it which are large in number, hence require good deal of re maintenance but which are comparatively less importa keeping inventory investment at the desired level. By ap ing this classification, materials manager can concentrate

a few important items which are responsible for the major ventory blockage. To control inventory investment then comes much easier.

-M-L Classification

This is another method of classification. Here 'H' stands r high value, 'M' for medium value and 'L' for low value. he logic is similar to that employed in A-B-C classifica- on. The items here are arranged, in the descending order f their unit value. Management decides the three categories y fixing limits for their values. Thus, for example, under -items management may include all those items which have nit values above Rs. 10,000/-. Range for M-items may be ixed for unit value from Rs. 1,000/- to Rs. 10,000/- and all hose items with unit values less than Rs. 1,000/- may be lumped in L-class.

On the basis of this classification management can del- egate authority to junior officers to purchase items of the 'L' class with unit values less than Rs. 1,000/-. The time of higher authorities is thereby saved for more important tasks. Top management can also decide that items costing over Rs. 10,000 can be bought only after the transaction is sanctioned by the General Manager.

F-S-N Classification

This type of classification is extremely useful in control- ling obsolescence. Since we are living in the modern era of rapidly shifting methods and procedures, and fast changing technologies, the items of to-day are likely to become out- dated tomorrow in the industrial world. Obsolescence may then result which will certainly contribute to profit decline. F-S-N classification promptly ascertains which items are tend- ing towards obsolescence or which have already become obsolete. This classification is based on the pattern in which items are issued from the stores. Accordingly, the items are classed as F - fast moving, S - slowing moving and N - non-moving items. The items from the last two categories need specific and careful attention of materials manager to control obsolescence.

S- and OS- Classification

Here the items are classified as 'Seasonal' or 'Off-Seasonal'. Items belonging to the seasonal class are available only at the time of their season and that at reasonable prices e.g. agricultural items like ground nuts, grains etc. Here the organisation based on seasonal items intake should purchase and stock them up as and when they are available in the market. EOQ does not play any role in this case.

Other inventory classifications

For machine spares and accessories we have Vital (V), Essential (E) and Desirable (D) groups. Class V includes spares or accessories which are absolutely necessary for plant working and hence they should be in sufficient stock. Their dearth otherwise, would hamper manufacturing operations.

Then we have G, L and F groups. G stands for Government, L - Local and F - Foreign. For stocking government controlled items and imported items their respective procedures have to be followed. EOQ again, has no standing here.

Similarly, scarce items should be treated differently from those which are easily available, for stocking purposes.

Overall out-look

There is no simple and straight forward rule to determine stock levels of different items. Materials manager has to see which item falls in which different categories before stocking it up. None of these classifications can be treated in isolation. An integrated view should be taken to decide the best course of action that will furnish the most profitable overall results.

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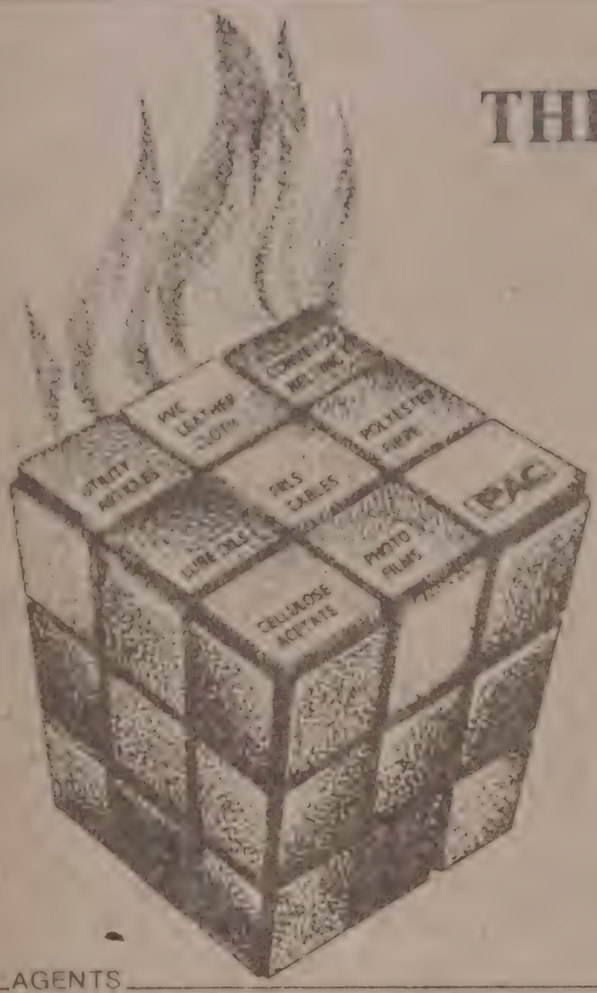

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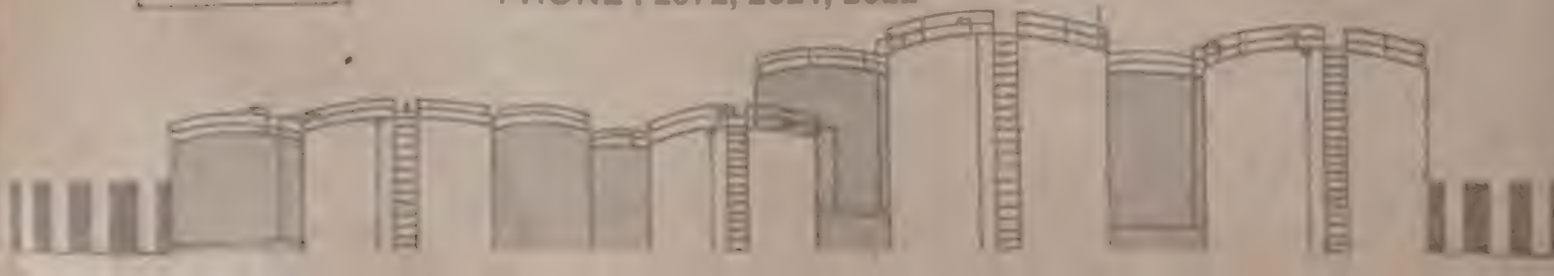

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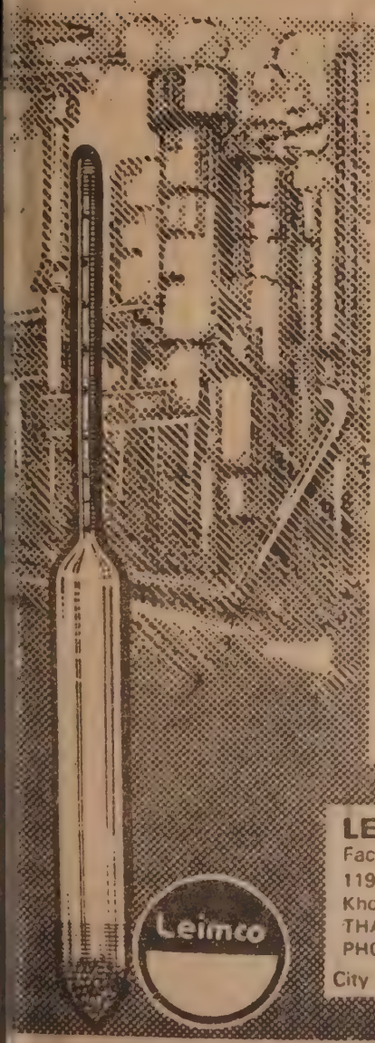

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POTLIGHT ON INORGANIC CHEMICALS

Phosphorous and Orthophosphoric Acid

B.A.V.K. SHARMA*

ntroduction

Orthophosphoric acid is an important intermediate chremcal for all plant and animal life. In the manufacture of a ferliser like ammonium phosphate from rock phosphate, rthophosphoric acid is the intermediate chemical.

Even in the manufacture of materials used for detergents, water treatment chemicals, food and pharmaceuticals from rock phosphate, orthophosphoric acid is the intermediate chemical.

There are mainly two types of processes available to manufacture phosphoric acid: the wet process involving reaction of rock phosphate with mostly sulphuric acid; and furnace process in which phosphorous is first produced followed by oxidation and hydration to give phosphoric acid. Phosphoric acid produced using rock phosphate and sulfuric acid by wet process contains almost all the impurities like arsenic fluorine, aluminium, iron, silicon oxides, magnesium and organic impurities that are found in rock phosphate. Wet process acid is mainly used for fertiliser production.

Phosphoric acid produced by furnace process is quite pure in quality and hence it is used in the manufacture of animal feed supplement, detergents, dentrifices and medicine.

Properties:

Anhydrous orthophosphoric acid is a monoclinic, clear and crystalline solid. M.P. 42.35°C. Sp. Gr. 1.88. Orthophosphoric acid forms a hemihydrate $2H_3PO_4$. H_2O that melts at 29.32°C. Soluble in water and alcohol.

85% phosphoric acid is a syrupy, mobile, clear and colorless liquid. Orthophosphoric acid is tribasic and hence forms three different salts. Aqueous phosphoric acid solutions have high acidity.

Manufacture:

Manufacture of high purity orthophosphoric acid is done by using thermal methods wherein the rock phosphate is reduced by coke and slagging is done by silica to produce elemental phosphorous which is oxidised and hydrated to produce pure orthophosphoric acid.

Tnere are two types of thermal methods: Electro-arc-furnace method as developed by J.B. Readman in 1888 and improved later; the blast furnace method, the proposal forwhich was made by Brison in 1868.

Electro-arc-furnace method

Phosphorous is made by smelting rock phosphate, coke and silica in a closed electric furnace. The reaction taking place is represented as follows:

$$2Ca_3(PO_{4)2} + 6SiO_2 + 10C \xrightarrow{1300°C - 1500°C} 6CaSiO_3 + P_4 + 10C0 \ (730 \text{ Kcal})$$

Raw Materials:

The raw materials required to make elemental phosphorous are rock phosphate, coke and silica.

Rock phosphate is pulverised to a size less than 0.1mm and made into pellets with the addition of dust from electrostatic precipitators used in the phosphorous furnace plant, alkali phosphates, clay and spent sulfite liquors.

The pellets are then calcined in rotary kilns to provide the necessary mechanical strength to avoid breaking up in the phosphorous furnace.

Silica used should be of 98% pure Fe_20_3 < 1% and size should be as large as that of the phosphate to maintain good gas flow through the charges. The SiO_2: CaO weight ratio should range between 0.8 to 1.

The coke used should have min 90% C, 9% ash and voltatiles should be as low as possible; the moisture content should be less than 2%. The particle size of the coke is that of rock phosphate and silica. The coke reactivity is also important.

The above materials if they contain iron the same is converted into ferrophosphorous in the furnace and phosphorous is lost as per the following equations:

$$Fe_20_3 + 3C \text{ ---- } 2Fe + 3CO$$

$$8Fe + P_4 \text{ ---- } 4Fe_2P$$

Hence the iron content in the raw materials should be a minimum.

The electrode that is used in the furnace is another raw material. Graphite electrodes which have the best conduc-

* Managing Director, Sharma Consultancy Services (Madras) Pvt. Ltd., 11, 2nd Street, 3rd Main, C.I.T. Extension, Nandanam, Madras 600 035.

tivity are generally used though they are considerably more expensive. The soderberg electrode is the cheapest and the paste consists of about 20% tar and pitch and 80% solid material, consisting of 45% coke and 55% graphited anthracite.

Furnace:

The furnace is triangular in shape and the electrodes are on the sides up to the height of the slag surface with hard burned carbon bricks 70 to 90 cm thick. The further lining consists of firebrick, and the roof is made of reinforced clay-aluminous cement, which also has a cover of anti-magnetic steel; this cover is divided into three parts each of which has an opening for an electrode. The three parts of the cover are insulated from each other and from the furnace body and the electrode. The lower part of the furnace and the bottom are water cooled.

The three transformers (single phase) are located closed to the furnace, each of the three is connected in a V-circuit scheme with two electrodes.

Furnace charge is fed around each electrode, four feeding chutes, extending 1 m inside the furnace. The middle feeding chute between the electrodes and common to all of them is larger in size. The furnace bottom slopes slightly to one side at the lowest point where the tap hole for ferrophosphorous is situated. The two slag tap holes are 40 cm above the bottom edge of the ferrophosphorous tap hole and on the opposite side of the furnace.

The furnace gas, consisting mainly of carbon monoxide, phosphorous vapour, and hydrogen passes through two openings in the furnace cover. The gas is passed through two electrostatic dust collectors at temperatures above the dew point of phosphorous (300°C) approximately 99% of the entertained dust is separated. The precipitators are followed by the phosphorous condensing unit which consists of two condensing towers operated at 60°C and 20°C with direct spraying of water into the towers.

The separated phosphorous from both condensers is transferred into tanks. The yield is 90% of the theoretical. The capacity ranges from 20 tons to 60 tons per day of phosphorous manufacture either in a single furnace or in a battery of furnaces adopting the continuous process.

Requirement of raw materials and power per ton of phosphorous:

	(90% yield)
Rock phosphate (31%)	8 MT
Quartz (97% SiO_2)	2.8 MT
Coke (90% fixed C)	1.25 MT
Soderberg electrode mass	50 kgs.
Electricity consumed	15,000 Kwh

By-products obtained, per ton of phosphorous are as fol

Slag	7.7 MT
Ferrophosphorous dust	100 kgs.
Precipitated dust	100 kgs

Heating gas (88% CO, 6% N, 4% H_2, 1% CH_4, 1% CO_2 -- 2700 m^3

Phosphorous obtained is converted into phosphoric by oxidation and hydration in a single vessel. The reac that take place are:

$$P_4 + 5O_2 \text{ ---- } P_4O_{10} - 3.015 \text{ mJ}$$

$$P_4O_{10} + 6H_2O \text{ ---- } 4H_3PO_4 - 0.293 \text{ mJ}$$

A spray of molten phosphorous is burnt in air and s in a combustion chamber made of stainless steel exter cooled in water. The existing gases are passed into a rator and hence through a venturi scrubber or electros precipitator to remove mist. The product acid normally tains upto 85% H_3PO_4 (62% P_2O_5), but concentration as as 84% P_2O_5 may be obtained which contains pyrop phoric and higher polyphosphoric acids in additio orthophosphoric acid.

The main impurity in the furnace acid is arsenic which be precipitated by hydrogen sulphide. The analysis of ical thermal acid is as follows:

Typical analysis of electro-arc-furnace orthophosphori

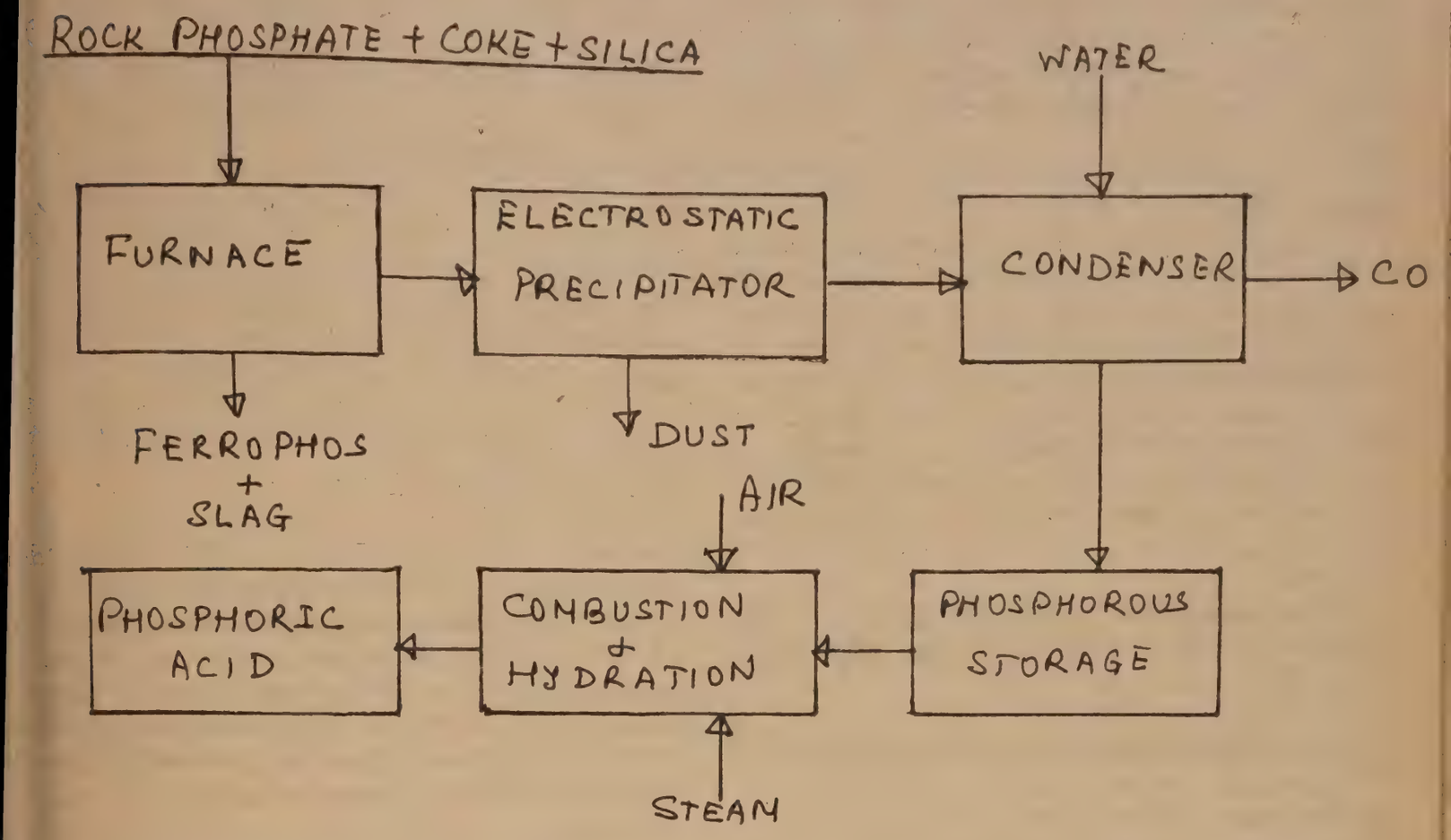
P_2O_5	62% (85% H_3PO_4
SO_3	0.002%
F	< 1 ppm
Ca	< 60 ppm
Mg	< 10 ppm
Al	< 10 ppm
Fe	< 10 ppm
Cr	< 0.5 ppm
Cu	< 0.5 ppm
As	< 0.3 ppm

Blast furnace process

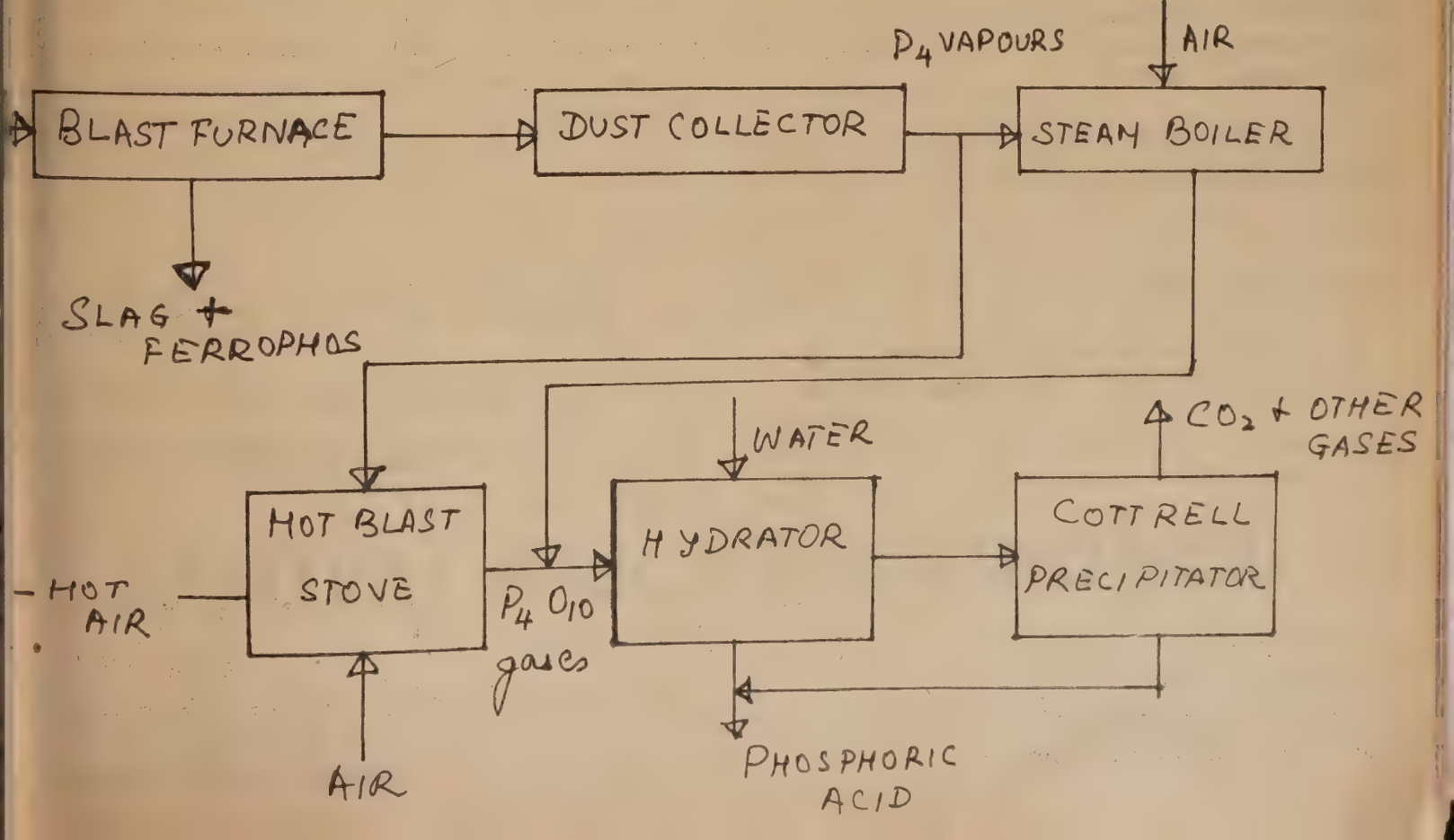
The raw materials, as usual rock phosphate, coke and si are charged into top of the blast furnace, preheated a blown in at the lower part of the furnace. The blast devel a temperature of 2400°F to 2500°F which furnishes the cesary reaction heat. Calcium silicate slag is tapped from furnace hearth once an hour, and the heavier ferrophosp ous is tapped every 12 hours.

The gas, containing phosphorous, carbon monoxide, nitrogen passes from the top of the shaft through the cycl dust collectors and special fume collectors. The clean gas

LOCK-FLOW DIAGRAM FOR MANUFACTURE OF PURE ITHOPHOSPHORIC ACID BY ELECTROTHEMAL PROCESS.



BLOCK - FLOW DIAGRAM FOR MANUFACTURE OF PHOSPHORIC ACID BY BLAST FURNACE



be passed through phosphorous condensors, second portion for steam generation and the third portion is passed into hot blast regenerative stoves, where it is oxidised to phosphorous pentoxide. The stoves furnish the preheated air to the furnace blast. The gaseous products from the stoves and sateam boilers are led into hydrating towers and cooling system then through cottrell precipitators for entrained phosphoric acid removal. The condensed acid may be purified by treatment with hydrogen sulphide and subsequent filtration.

Requirements of raw materials for 1 ton of orthophosphoric acid (85%) manufactured in fuel fired blast furnace.

Phosphate Rock (31% P_2O_5)	1.95 MT
Sand	0.61 MT
Coke	2.7 MT

Pollution

The water from the condensers presents environmental problems because it contains suspended phosphorous, oxy-acids, hexafluosilicic acid and silica. The emission of gaseous hydrogen fluoride has to be taken care of. The solid wastes like slag, ferrophos, unreacted phosphates poses disposal problems.

Uses

Calcium phosphate low in fluorine content is used in animal husbandry as a feed supplement to have dietary balance. Monocalcium phosphate is used in human food as leavening agents for dough and batter; an important acidic raw material for baking powders. Very dilute phosphoric acid is used as an acidualant in soft drinks such as colas.Tetrasodium pyrophophate causes milk casein to gel thus forming instant pudding.

Condensed phosphates are used in meat, cheese, fish, and poultry processing where they retain the main structure during cooking, improve fat distribution and give a final product improved color and flavour, without loss of nutrients. Phosphoric acid is used in pickling of steel where the acid leaves a think protective film of phosphate bonded to the metal. It is also used in chemical polishing of metals like aluminium, copper and stainless steel.

Phosphoric acid is used as catalyst in the telomerisation of ethylene and propylene. Phosphoric acid catalyses the dehydration of cellulose to carbon and water rendering it flameproof. Ester phosphate is useful in removing uranium from solutions. The biggest use of phosphates is in water treatment and detergents. Phosphates are used in mineral flotation and in the manufacture of plasticisers. Phosphates are used in coating clay into paper.

Conclusion:

Thermal process acid compared to wet process is of high strength and is suitable for all applications, including food. But unfortunately the manufacture of thermal acid is quite complex and high energy intensive and price-wise four times costlier than the wet process acid of similar strength. Hence thermal acid is being increasingly substituted by wet process acid in all but the demanding applications.

The blast furnace route to phosphoric acid is not much successful.

Further the electrothermal process is plagued with by products of low value slag, CO_2 and ferrophosphorous.

With the introduction of solvent extraction and ion exchange methods to purify wet process phosphoric acid the importance given to electro thermal process will greatly be reduced restricting it to produce phosphorous required to make products other than phosphoric acid.

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New Developments from Japan

TSUKA CHEMICAL PLANS EW TYPE OF POTASSIUM TIT-NATE WHISKER

Otsuka Chemical has succeeded in e development of an entirely new type f potassium titanate whisker that fea-ires high crystallization and pH neu-ality. The company announced that it ill begin commercial production after onstructing equipment for mass pro-uction in its Tokushima city factory.

By improving on conventional raw naterial compositions and the current manufacturing methods for flux, Otu-uka Chemical has successfully devel-oped a product with functions unavailable in the potassium titanate whisker presently marketed.

Taking advantage ofits neutrality and nigh degree of crystallization, Otsuka Chemical is exploring marketing appli-cations such as: for reinforcement in super engineering plastics, electric and electronic parts which inhibit alkaline contact, and a reinforcing material for fiber-reinforced metal (FRM).

The new production facility has annual capacity of 1,200 tons, and com-pletion is slated for November. After initially running-in, full commercial operation will start early next year.

HEAT-RESISTANT EPOXY RESINS MARKETED

Yuka Shell Epoxy K.K. has commer-cialized bifunctional/polyfunctional glycidyl ether-type high heat-resistant epoxy resins (trade name: Epikote YX-4000, 1032): they can withstand high temperature of more than 200°C.

Their potential applications are encapsulating material for semiconduc-tors, powder paint and advanced com-posites, etc. They feature low stress andwell-balanced physical properties as well as tough heat resistance.

Epoxy resin is extensively used in semiconductor and composite-related fields due to its excellent workability and well-balanced physical properties. There is, however, ample leeway to beef up the resin's resistance against heat and moisture.

Commercialization of large capacity high-density electronics parts and high-performance carbon fiber-applied composites calls for supply of epoxy resin having tougher thermal resistance. Every epoxy-resin maker is trying to develop new types of epoxy resins use-able at temperatures higher than 170°C.

FINE POLYSTYRENE PARTI-CLES HAVING CORRUGATED SURFACE DEVELOPED

Sekisui Plastics Co., has developed nonporous fine spherical polystyrene particles (trade name: Techpolymer-WRS) having a corrugated surface. Their diameters range from 10 to 80 microns. A particle with a 40-micron diameter has a surface area of 0.47-0.6 m^2per gram, 1.2-2 times that of an ordinary spherical particle of the same diameter.

The new particles are produced by means of a suspension/polymerization process. It is possible to control the size and density of the grooves (corruga-tions) formed on the said surface.

Potential applications of the new pro-ducts are carriers for immobilized enzyme and diagnostic agents.

Porous fine particles excel in slowly releasing targeted marterial which was absorbed thereto in advance. Their pores are, however, so fine that they cannot efficiently adsorb the targeted material.

The new fine polymer particles have excellent adsorptive capability since their grooves are uniformly formed on their surfaces. They will serve as car-riers designed to efficiently adsorb tar-geted material.

TAISHO PHARMACEUTICAL TO TEST ICI'S ANTI-ARRHYTHMIC AGENT

Taisho Pharmaceutical Co., is sche-duled to introduce "Visacor" ß-blocker from ICI (U.K.) and put it to clinical tests within this year: the drug will be applied to the treatment of arrhythmia and angina pectoris.

The agent has high-level selectivity for $ß_1$. The Japanese market for anti-arrhythmic agents stands at roughtly Y40 billion.

The Japanese drug maker is empha-sizing commercialization of anti-arrhythmic agents. Taisho Sanofi S.A. — a joint venture between Taisho Pharmaceutical and Sanofi S.A. (France) — is conducting phase-III clinical trials for "Amiodarone"a-gent. Taisho Knoll Pharmaceutical Co., — jointly owned by Taisho Pharma-ceutical and Knoll AG (W.Germany) — is pushing forward phase-II clinical tests of "Gallopamil" agent.

Anti-arrhythmic agents are classified into groups. I, II, III and IV in accor-dance with their pharmacological actions. "Amiodarone", "Gallopamil" and "Visacor" are categorized as group-III, IV and II products, respec-tively.

"Aminodarone" is highly effective against lethal arrhythmia. "Gallopamil" will be used as a calcium antagonist effective against angina pectoris and arrhythmia.

Incidentally, ICI-Pharma Ltd., ICI's Japanese subsidiary — is also scheduled to start marketing "Corwin" agent effective against chronic cardiac insuf-ficiency.

BLOOD SUBSTITUTE PREPARED FROM AIDS-INFECTED BLOOD

Ajinomoto and Fujirebio, Inc. have been collaborating on the development of a blood substitute using human haemoglobin, and have recently confirmed that using blood contaminated by the AIDS virus as the initial ingredient will not jeopardize the safety of the final product.

They claim to have established a manufacturing technology which will virtually destroy the activity of the AIDS virus by using, for instance, a refining method that uses an ultrafiltration membrance. As AIDS is becoming more and more widespread, increasing quantites of extracted blood have to be scrapped due to being contaminated with the lethal virus. If such contaminated blood can be used as a raw material in manufacturing blood substitute, it will greatly contribute to more efficient utilization of human blood.

Experiments were conducted in a P-3 facility at Fujirebio's Ube Laboratory, with blood that had already passed its expiration date supplied by the Japan Red Cross. Researchers added a solution contaminated with the AIDS virus, and then used the mixture as the initial raw material for preparing the blood substitute.

After initial rinsing, the walls of the red blood cells were dissolved to extract the haemoglobin, which is then combined with polyoxyethylene and pyridoxal phosphate to form the blood substitute. Researchers examined the substitute to see if the AIDS virus had been eliminated by the introduction of refining processes, such as an ultrafiltration membrane with a fractionating capacity of a molecular weight of 300,000, or by treating it with 20% ethanol.

According to the experimental results, the contamination level of the virus decreased to less than one 14-trillionth of the initial concentration, which can safely be assumed to be a non-contaminant level. The level of contamination was confirmed by two methods: the Plaque Assay method and the Enzyme Immunoassay method. As the final product is in a freeze-dried form, there is virtually no possibility of the virus still being present at this stage.

The blood substitute that the two companies are developing is called a "stabilized haemoglobin". Red blood cell derivatives in the present use have an expiration period of about three weeks, but the new product can be kept and used for up to one year. Other beneficial features include: an excellent capacity for carrying oxygen, an ability to keep the total blood quantity at an appropriate level, and minimal levels of toxicity in liver and kidney functions, as proven in animal experiments.

THIN CERAMIC LAYER FORMED ON FINE PARTICLES: NISSHIN

Nisshin Steel Co., has test-manufactured gold-coated silica particles and titanium dioxide-coated organic pigments using a sputtering method. The new technology is capable of forming a thin ceramic (oxide) layer on the surface of fine particles. The titanium dioxide-coated organic pigments will facilitate manufacture of weather and corrosion-resistant pigments. It is possible to produce an aluminum-oxide layer upon the surface of organic pigments using the same technology. The gold-coated hollow silica particles will lead to production of conductive filler.

The company has produced them by agitating the particles concerned within sputtering equipment incorporating a horizontal barrel-type chamber. The said thin layers were formed in an argon-gas atmosphere. It claims the lower the argon pressure is, the higher the sputtering/coating speed. The sputtering equipment is simpler than dry-coati (ion-coating) equipment and can eas be scaled up. To date the company h produced copper and nickel-coat iron/tungsten particles, glass beads a mica (they measure several ten micror using an electroplating process.

They are utilized as conductive fil and electromagnetic interferenc shielding material. The process is, ho ever, incapable of forming a th ceramic (titanium dioxide and taniu nitride) layer upon targeted particle

OXETENOCIN ANTIBIOTIC COMPLETELY SYNTHESIZED: RESEARCH GROUP

A research group at the College Engineering, Keio University has su cessfully developed a synthesis proce for an oxetanocin antibiotic (adenin type nucleoside) having a unique nucl oside structure (oxetanocil adenine) ar high-level physiological activit —antivirus properties in particular.

Oxetanocin thereby synthesized exactly the same as the natural produc High hopes are placed on its comme cial production. The new process is ca able of producing thymine an uracil-type nucleoside as well a adenine-type nucleoside (oxetanocin). is expected to help in the pioneering c high-performance antivirus agents.

PLASMA CLEANER DEVELOPE FOR MYASTHENIA TREATMEN

Asahi Medical Co., has developed blood-plasma cleaning apparatus t remove an anti-acetylcholine recepto antibody causing heavy myasthenia The apparatus is designed to specificall separate the said substance form th blood plasma of a patient utilizing th principle of physical affinity.

The company is seeking pater approval for the apparatus in Japan, th U.S. and Europe. When patents ar granted, it will manufacture and mark the product under a global strategy.

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NEWS FROM ABROAD

BROWN & ROOT UPS CHEMICALS POSITION WITH CF BRAUN BUY

In a move designed to strengthen Brown & Root's technological capabilities within the petroleum & chemicals induntry, the US engineering and construction company has acquired the process engineering firm CF Braun, previously owned by Santa Fe International Corp, which is renowned for its proprietary process technology, especially for ammonia and ethylene.

The acquisition "brings Brown & Root into the same engineering leadership in the petroleum and chemicals industry that we've enjoyed for so long in the marine, civil and fine paper industries," said W B Pieper, Brown & Root's president and ceo. Braun's engineering know-how combined with Brown & Root's construction capabilities "give us the best across-the-board balance in the process industry today," he added.

CF Braun is an "extremely complementary fit" with the services currently on offer to the chemical and petrochemicals refining industry, said Stephen Grote, Brown & Root's senior vice president for its petroleum and chemicals business unit. Braun is very strong in process engineering in the ethylene, ammonia and refining areas, he said. And the acquisition will give the company the capability to perform turnkey projects in everything from oilfield production to downstream refining.

Initially, Braun will be integrated into Brown & Root's petroleum and chemicals unit, which is expected to have a turnover of around $800m of the company's projected revenue of $2.5bn in 1989, said Grote. However, he expects Braun's influence to be felt gradually throughout Brown & Root's other engineering capabilities.

The two companies have already worked together on several major petroleum and chemicals projects, and are currently working under separate contracts for Phillips Petroleum in the engineering and construction of a 680,000 ton/year ethylene plant in Sweeny, Texas. "We've put our skills together at a very propitious time", commented Joel Bennett, Braun's senior vice president, "we're well positioned to participate in a growth market". Industry sources estimate that the petroleum and chemicals industry will spend around $70bn on major projects worldwide over the next five to six years.

The move represents the blending of a very capable civil- and marine-oriented engineering company with a similarly capable technology-based company, said a spokesman for MW Kellogg. The combination of the two companies could be "quite a powerhouse" and a "formidable competitor," he said, depending on the success of the merger of the two companies' activities. Another US competitor, Stone & Webster described the purchase as "very beneficial to Brown & Root," providing it with an engineering company with a very good reputation.

CF Braun will continue to operate from its offices in Alhambra, California, and will serve as the west coast centre for Brown & Root's petroleum and chemicals operation.

DRUGS FIRMS STALK CL PHARMA

Five or six pharmaceutical companies are currently in the running to acquire the Austrian drugs company, Chemie Linz Pharma, which has been put up for sale by its owners. Austria Tabakwerken, which holds a 45 per cent stake in CL Pharma, prompted the sell-off with its decision to pull out of the group. In 1988 CL Pharma posted profits of Sch14m ($1.03m) on sales of Sch2bn.

Chemie Linz Holding, which owns the remaining 55 per cent of the company, is looking for a suitable partner in the drugs industry which could provide much-needed pharmaceutical know-how and sufficient R&D funding. A management buyout is considered unlikely but has not been ruled out. It is also possible that Chemie Linz will give up the majority stake, said a company spokesman.

Discussions have been held with a number of companies, believed to include Swiss major Sandoz, BASF's pharmaceutical subsidiary Knoll AG, plus another, as yet unnamed, West German company and a Norwegian firm. The talks have been "very satisfying for us", said the spokesman. However, a further announcement is not expected until late autumn.

CL Pharma's principal products are in the anti-rheumatics, blood plasma and cardiovascular areas.

DEMOCRATS FIGHT SALE

The New Democratic Party (NDP) opposition in the Canadian province of Saskatchewan has spent the last four months filibustering in an attempt at delaying the passage of a bill to privatize the provincially-owned Potash Corp of Saskatchewan (PCS).

Opposition leader, Wain Lingenfelter said PCS is "fundamental to the long-term economic security of the province," and could be used "to free ourselves of the deficit or create new social programmes."

R-P EXPANDS SEEDS WITH UK PURCHASE

Rhone-Poulenc Agriculture is further expanding its seed treatment activities with its agreement to acquire Shell Chemicals' seed treatment business in the UK.

The move follows closely on the heels of Rhone-Poulenc's purchase of Keno-Gard's worldwide seed treatment and plant protection business from Nobel Industries, of Sweden. Shell acted as KenoGard's distributor in the UK and had an exclusive position on a proprietary range of seed treatment machinery and chemicals.

"While maintaining the high standard of customer service established by Shell, Rhone-Poulenc will be able to provide a broader range of products, both now and in the future", said David Gilbey, UK agrochemicals manager for Rhone-Poulenc Agriculture. The acquisition will enable the company to forward integrate into the seed treatment business, he said, allowing R-P to deal directly with seed merchants and to supply them with product brands, service machinery and work on developing new chemicals and coating technologies.

The seed treatment market in the UK is fairly modest at present, with manufacturers' sales at just over £11m ($17.6m), according to the British Agrochemicals Association. However, Gilbey anticipates that this is likely to expand significantly, given the effectiveness of the technology.

In the UK, Rhone-Poulenc's seed protection products are to be handled by its specialist technical division, Embetec Crop Protection.

NEW RULES FOR BIDDERS AT ITAGUAI COMPLEX

Companies wishing to bid for projects at the proposed Itaguai, petrochemicals complex in Brazil, will need to follow new rules drawn up by the industrial development secretariat (SDI). Under new guidelines, each proposal needs to include investment earmarked to finance construction of the complex's basic chemicals supplier.

Zick Moyses Junior, SDI's coordinator of chemical and petrochemical projects, explained each project will need to contribute an amount in proportion to the volume of material consumed. Projects already under study have been returned to their proposers to revise and adapt to the new rules.

According to initial calculations, this new requirement will probably add some 10 to 20 per cent to project costs. Plans being returned for revision include those submitted by Deten, EDN, Oxiteno, Pan Americana, Polladen, Polisul and PPH. CBE's proposal includes a $20m investment to cope with the rules revision.

DOE MULLS ENVIRONMENTAL COSTING INITIATIVE

The introduction of taxes on environmentally harmful products is one proposal put forward in a report which is to provide the basis for policy decisions by the UK department of environment. The report, Sustainable Development by Professor David Pearce, also calls for the treasury to take environmental assets into account when calculating GNP. All environmental amenities would have a value attached to them and a form of environmental accounting would assess the "green wealth" of the country.

The concept of sustainable development was introduced in the 1987 Brundtland report. It involves an increased emphasis on the value of the environment and a concern with the longer term not usually considered in economic analysis. The underlying concept is that future generations should not be disadvantaged as a result of present policies.

The report emphasizes that the concept has implications for the way economic progress is recorded, for project appraisal, for the pricing of goods and services and for economic policy generally. Pearce stresses that the choice is not between higher or lower rates of growth but between different ways of attaining growth in the economy. Growth should cover improvements in quality of life as well as in real income.

Adoption of the report's proposals would clearly have a significant effect on industry, in particular the chemical industry. The British Agrochemicals Association (BAA) expressed great concern at

the possibility of a pollution tax on pesticides and fertilizers. "It would put farmers in a terrible dilemma," said a BAA spokesman, "it is not very fair at all." Farmers switching from conventional to organic methods must suffer two to three years of low income before achieving any sustainable growth, he said. Arable farmers are already experiencing a drop in income of 9 per cent/year while using the minimum amount of pesticides without suffering economic loss from the crops.

It is difficult to see how farmers can reduce their use of agrochemicals further, said the BAA spokesman. They have already reduced their use of pesticides 41 per cent in the last 8 years, he added. Although the BAA agrees that a reduction in pesticide use is "the way we should be aiming in environmental terms," it considers the methods proposed need considerably more debate.

Environmental groups have initially welcomed the proposals in the report.

BP AND AKZO AGREE ASSET SWAP

BP Chemicals and Akzo have agreed on the swap of assets from their specialities portfolios first discussed in May. Akzo's oilfield treatment chemicals business is to become part of BP Chemicals' oilfield chemicals operation, OFRIC, while BP Chemicals has sold its Gemex business to Akzo.

Akzo's offshore chemicals business, which is run from Aberdeen in Scotland and Sandnes in Norway, will be fully integrated into OFRIC, which is also based in Aberdeen. BP Chemicals considers the addition of the Norwegian dimension will allow it to provide a more effective and comprehensive service to its Norwegian customers. The two businesses "complement each other in terms of market position and both are based on advanced technology — which is the direction we see the business moving in future," said Ken Johnson, manager of BP Chemicals oilfield businesses.

The Gemex business is sited in southern England. Gemex is a surface-active agent which aids demulsification in the manufacture of penicillin. It is a sector in which Akzo is more involved than BP, said BP. Terms of the transactions have not been disclosed.

ROHM & HAAS TALKS WITH KUREHA

Rohm & Haas (UK) is discussing a joint venture with Japan's Kureha Chemical Industry Co. to produce plastics additives to be marketed in Western and Eastern Europe. The additives are used as impact modifiers and process aids for PVC and serve the growing modification requirements for engineering thermoplastics.

If the jv goes ahead Rohm and Haas will retain the controlling share of the new company. Its limited additives plant at Grangemouth, Scotland, would be incorporated into the joint venture company, which would take over responsibility for completing the recently announced expansion at the plant.

The project, scheduled for completion in late 1990, will bring production capacity up to 45,000 ton/year. It will produce both acrylic impact modifiers as well as methyl methacrylate and butadiene styrene copolymers.

RIO RODANO LINKS WITH REPSOL IN JV

Rhone-Poulenc's Spanish subsidiary, Rio Rodano has established a joint venture in resins with Repsol Quimica, the petrochemicals subsidiary of the Spanish state-owned company, Repsol. The 50:50 joint venture will combine the plants in Alcala de Henares and Miranda de Ebro, which manufacture polyester resins, phthalic anhydride and plastifiers.

The new company will hold over half the production capacity for polyester resins in Spain. The combination of the two companies' interests and know-how in this sector will allow the joint venture to develop both on a national and international scale, says Rhone-Poulenc. Turnover for the new company, Resinas Poliesters SA, is forecast at an estimated FF500-600m ($78-94m).

STATE GIVES GO-AHEAD TO VEBA ACQUISITION

West Germany's federal cartel office has cleared Veba AG's purchase of a 46 per cent stake in Feldmuehle Nobel, a paper, chemicals and engineering company. It has also given the go-ahead, in principle, for Veba to increase its holding in Feldmuehle to over 50 per cent.

However, Veba has said that it has not yet decided on any further boosting of its interest in the company and that merger plans are still in an investigative phase.

Industry observers are forecasting that Veba will make a bid for a majority holding or for all of the remaining shares in late 1989 or early 1990.

With Feldmuehle's shares currently valued on the market at DM 400/share ($211), the whole group is worth around DM2.8bn.

Chemical Markets Abroad

PX STABILITY THREATENED BY MAINTENANCE SEASON

A series of maintenance shutdowns into October threaten to increase uncertainty in the paraxylene market. With up to 50,000 ton/year of European capacity lost between now and the end of October, a tighter supply seems imminent.

Of the shutdowns, UKW has already closed its 80,000 ton/year plant, which players suffering outages claim to be virtually covered for their closure, either through swap deals or short-term contracts. What presently intrigues the market is how much surplus material is available on the ground, to meet various contract commitments.

Throughout 1989, the paraxylene market has become increasingly volatile. It has suffered two spot price crashes in the first half of the year, burning a number of traders' fingers. The latest shutdowns can only increase the fragility of the market structure, further clouding any attempt at assessing market trends.

In recent weeks paraxylene spot prices have risen, as Far East interest has generated a great deal of activity. In early July spot numbers stood at $595-605/ton fob Rotterdam, now rising to $645-655/ton fob Rotterdam.

Indian buyers have forwarded tenders for two 5,000 ton parcels of paraxylene. As competition to capture these tenders has increased, more and more unrealistic numbers have been agreed. An original settlement of $635/ton cif Bombay had to be renegotiated after the seller was unable to find product to cover the sale at the price offered.

Herein lies the crux of the problem, as the market is aware of Indian demand as soon as an offer is heard, speculative interest moves prices out of the range of the proposed settlement.

Once production begins at the two delayed Far Eastern PTA units, prices could rise, argue producers. Sukyong of South Korea, is due to commission, its 160,000 ton/year PTA plant in October. Formosa Chemicals and Fibres (FCFC) is believed to have entered the primary commissioning stage for its 200,000 ton/year plant, although, it is not expected to reach full capacity until the end of the year.

Paraxylene customers view the current market somewhat differently. They point to the fall in feedstock costs. In early June virgin xylene stood at $425-430/ton fob NWE, since then they have slumped to $305-310/ton fob NWE. It is argued that this factor should be recognized by producers, in any future price negotiations.

Paraxylene maintenance shutdowns (Q3-Q4)

Company	Plant	Capacity	Month	Approx. time (weeks)
UKW	Wessling	80,000	August	4
Petrogal	Oporto	120,000	September	3-4
Total	Gonfreville	70,000	September	3-4
Veba	Gelsenkirchen	120,000	October	2-3
ICI	Wilton	150,000	October	3-4

BUTADIENE Q3 CONTRACTS SETTLED

The butadiene contract price of FF2,350/ton for the third quarter has now been taken up throughout Europe, following the lead established after lengthy negotiations by Exxon and Bayer France, two weeks ago.

Butadiene spot prices have risen sharply in Europe over the last two months but buyers were able to negotiate a favourable contract deal.

Butadiene is trading at $380-390/ton, (equivalent to FF2,500-2,566/ton) whereas in early June the market level was $285-295/ton. The price increase was caused by a spate of cracker shutdowns throughout Europe earlier in the year. The 520-000 ton/year Lavera 4 cracker operated by Atochem and BP suffered a force majeure and industrial disputes held up production at several other plants.

However, sellers compromised with a lower contract price than might otherwise have won. One source said thin was because buyers pointed out that butadiene prices looked set to drop in the US during the fourth quarter.

STOLT EXPANSION

Stolt Tankers and Terminals has completed the first phase of improving its Stolhaven terminal, in Houston. The initial expansion cost more than $10m and has added 36 new storage tanks to the complex, lifting total capacity to some 127,000 cubic metres.

Chairman and ceo, Jacob Stolt-Neisen Jr, announced the details of a phase two extension of the Stolthaven terminal, at the opening ceremony. The work will cost another $20m and increase storage capacity by 30 per cent.

SPECIAL REPORT :

Plastics producers face up to waste disposal problem

As the industrialized nations run out of environmentally acceptable places to dispose of solid waste, increasing pressure will come to bear on plastics producers to offer a solution. One technological approach has been the development of degradable plastics. However, US-based consultant, Chem Systems Inc believes that rather than degradability, waste-to-energy incineration offers the greatest potential to reduce waste volumes.

The industrialized nations of the world are faced with a serious and growing solid waste disposal problem. They are running out of environmentally acceptable places to dispose of their waste. Sanitary landfills in the US, for example, are at capacity, leachates from landfills have led to ground water contamination and current methods of incinerating municipal solid waste have led to high levels of air pollution.

While plastics remain a relatively small portion of total solid waste, 7.2 weight per cent, their presence in the waste stream has been duly recognized by consumers and legislators, enough to create a potential threat to plastics in the marketplace. Indeed, plastics represent a volume of 30 per cent of total solid waste and as much as 60 per cent of total litter.

Continuing world growth

Earlier this year at the Chemical Market Research Association's meeting in New York, Fred Hajduk, director of business planning and development, Quantum Chemicals, forecast a compound growth rate of 4.1 per cent/year for world consumption of polyolefins in packaging.

There was a time when disposability was a characteristic that promoted the growth of plastics. Now that advantage threatens to retard plastics' growth or, in some applications, eliminate plastics as a competitive material.

All consumers want to eliminate the solid waste disposal problem, as do manufacturers, legislators, and trade groups. The issue to be resolved is how best to solve that problem efficiently, economically and promptly. The disposal of plastics waste elicits pro and con arguments for the three major disposal techniques currently available — degradability, recycling, and incineration. A fourth method, an outright ban

Summary forecast per capita polyolefins packaging consumption

	1987	1995
Canada/US	19.45	23.3
Japan	12.27	14.5
Western Europe	12.09	15.4
Oceania	8.73	11.04
Latin America	4.14	7.3
Eastern Europe	3	5.8
Asia	1.3	2.6
Africa	0.7	1.18
PRC	0.3	1.1
World	3.6	4.98

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of plastics, presents feasibility issues that automatically remove it from consideration.

The New York-based consultant, Chem Systems believes the US trials behind the other industrialized nations in utilizing the more practical, i.e. in terms of energy and resource recovery, methods of recycling and incineration. US consumers believe that degradability is the answer to reducing plastics waste. Their influence with legislators has led to laws requiring a ban or tax on materials that are not degradable.

Manufacturers of raw materials and plastics products cite several factors in opposition to the degradability concept. These include the negative impact on food packaging purity, higher manufacturing costs than those for non-degradable products; the generation of potentially dangerous gases and destabilization of the landfill; and degradation before the product has completed its purpose.

There are, however, several companies that have developed degradable polymers utilizing photodegradation and biodegradation technologies. Demand for these polymers derives from a need to satisfy the mandated legislation.

Current technology

Current biodegradable polymer technology includes three types: aliphatic polyester compounds, such as polyhydroxybutyrate-valerate (PHBV); addition of starch to olefinic and styrenic copolymers; and addition of starch and autooxidant to similar copolymers.

The inclusion of non-plastic materials into the polymer reduces the volume of plastics resin, sometimes, in the case of blown film, by as much as 60 per cent. Photodegradation technology utilizes a modification of the polymer molecule to produce materials subject to degradability when exposed to ultraviolet radiation.

The introduction of carbonyl groups through the incorporation of carbon monoxide into polyethylene, but not linear low density, or polystyrene, does produce degradable polymers, but only if they are exposed to UV radiation in the landfill. Typical products produced from these technologies are bottles, mulch films, trash bags and blown film.

Global disposable methods (per cent)

Region	Landfill/ Other	Recycling/ Reuse	Incineration
US	85	10	5
Western Europe	55	15	30
Japan	25	5	70

In the US, less than one per cent of total plastics waste is recycled. However, plastics, such as high density polyethylene used in milk bottles and polyethylene terephthalate (PET) used in beverage bottles, which are easily identifiable in the waste stream, have a higher degree of reclamation.

By 1992, it is forecast that more than 1.1 trillion lb (500m ton) of these materials will re-enter the marketplace as drums, toys, pails, fibres, crates, pipes and many other products. For hdPE the market for recycled products is forecast to grow from 50m lb in 1987 to 560m lb in 1992. The beneficiaries of this growth will be the fabricators whose profit margins will rise. Polymer suppliers are likely to find lower demand for their virgin resins. Acquisition of, or joint ventures with, recycling companies would provide the polymer sup-

Incinerators in the EC (1987)

Country	Number of MSW incinerators	No. of plants 200 ton/day	No. of plants with heat recovery
Belgium	27	9	15
Denmark	48	8	*
West Germany	45	40	40
Greece	1	0	1
France	250	37	254
Ireland	0	0	0
Italy	84	21	84
Luxembourg	1	1	0
Netherlands	11	10	10
Portugal	0	0	0
Spain	7	2	7
UK	40	32	6
Total	524	160	416
Per cent		31	80

* No data

Source : The EC Commission, Swedish Naturvardsverket.

pliers with another source of resin.

The most promising plastics waste reduction technology, according to Chem Systems, is in waste-to-energy incineration, which offers the potential of reducing waste volume by 80-90 per cent. The high calorific value of plastics especially, is an incentive to separate and burn these materials as a synthetic fuel. Polyethylene provides 43,600 Btu/kg versus 41,700 Btu/kg for heating oil, and 25,400 Btu/kg for coal.

Objections to facilities

Yet there are several objections to the technology, or more specifically, to these facilities. In the US, consumers point to disappointing power sales to utilities, ash filled with toxic heavy metals, higher taxes, lower property values, and increased truck traffic as reasons not to have such a facility in "my backyard," the so-called "Nimby" syndrome.

As in the nuclear power debate, Chem Systems believes it will take time and experience to determine if incineration is a safe, economical means to reduce waste volume.

Whatever technology is considered, the solid waste problem is significant and immediate, says Chem Systems.

Polymer suppliers, fabricators, and trade organizations are already addressing this issue through research and development of modified polymers, support of recycling programmes and organization of consumer education programmes. At stake is the image of plastics and their place in society. In the US, for example, several hundred anti-plastics bills are proposed each year. This level of legislation is likely to continue until methods of waste disposal dramatically reduce plastic levels from the total waste stream.

Significant & immediate

The solid waste management issue has become increasingly important for the plastics industry. Indeed, in the US it has become an issue of national importance. The published information on the problem and the suggested solutions are enormous; yet the average consumer and the decision-makers are not sufficiently educated on the relative impact of the proposed solutions. Consumers react to solid waste issues only when they are directly affected, by increased taxes, increased cost of products, or the siting of incineration facilities.

Whatever technology is considered, the management of solid waste is a serious issue that is significant and deserving of immediate attention.

Japanese plastics waste by polymer type (1988)

Polymer	Per cent
Polyethylene	40
Polypropylene	30
Polystyrene	15
PVC	10
Other	5
Total	100

Japanese plastics waste by product (1988)

Product	Per cent
Film	45
Molded products	30
Bottles	10
Foamed products	10
Nets, rope, composites, other	5
Total	100

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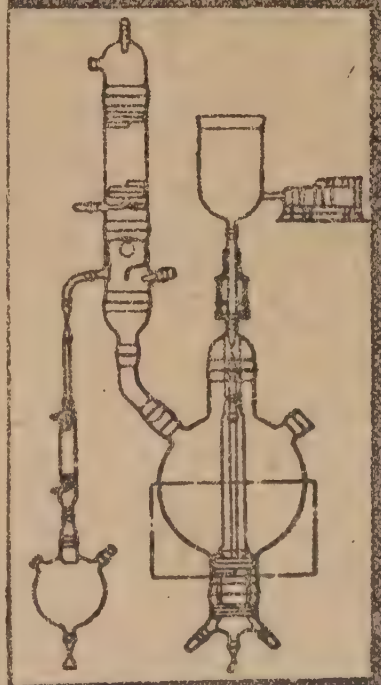

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Chem Systems believes that an integrated approach to recycling and incineration, plus landfilling where feasible, represents the best plan for solid waste reduction. Degradability, as Chem Systems has measured its relative value, is the least attractive option to pursue, except in specific markets, which is agricultural mulch film, where that technology would be advantageous.

Disposable culture

The disposal of personal trash is a matttr of habit, most of which is hard to break. When it comes to garbage, Chem Systems says Americans' routines are rooted in the psychology of a disposable society — a society dedicated to carryout and convenience, to disposable diapers and dishes, to throwaway roasting and pans and razors. The US is a culture of planned obsolescence in which no product is made to last a life-time. Even so-called durable products eventually find their way into the waste stream. It is more practical to throw away broken refrigerators ,clocks, and filing cabinets than to repair them, as the Japanese and Europeans are more willing to do.

The US produces more than 160m ton of garbage/year, about two thirds of a ton/person. Consumers do not consider what is in the garbage, only that it must be disposed of because it is unsightly, malororous, and potentially unsafe and hazardous. Clearly, the consumer believes that it is the responsibility of "someone," it does not matter who, to remove this material from his sight so there is room for more garbage to be generated. "Out of sight, out of mind" is the phrase that typifies attitudes toward garbage.

A bag of garbage provides an insight into personal lifestyles and identifies status in society. An analysis of municipal landfills with varying lifetimes shows the changes in society over time. Dr. William Rathje, an anthropologist at the University of Arizon and a leading "garbologist," has studied US garbage for 15 years. Rathje and his colleagues noticed an increase in takeout and frozen food containers resulting from more women in the workplace, having less time to prepare meals, more type AA and other batteries, due to the increase in walkman-type radios, toys, and calculators; old telephone books, as a result of dependence on the telephone; and used tyres, from the increasing number of automobiles.

Consumer awareness

The need to do something about the solid waste disposal problem is gradually becoming apparent to the consumer. Garbage becomes visible only when it no longer can be ignored, as when the bag overflows or the landfill reaches capacity. Most consumers do not want to be boothered with this issue, but when forced to act through legislation, they will comply, albeit reluctantly. Chem Systems believes the time has come to reevaluate our attitudes toward waste disposal before garbage alters society's current lifestyle.

Plastics waste in the EC (1987) (ton m)

Post-consumer waste	
Municipal waste	6.1
Industrial waste	
Distribution	1.0
Automotive	0.4
Agricultural waste	0.3
Manufacturing waste	0.2
Total	8.0

Demand for plastics with a potential for degradability (1990) (lb m)

Plastic	Estimated demand
High density polyethylene	800-900
Low/linear low density polyethylene	2,500-3,000
Polypropylene	500-600
Polystyrene	2,200-2,500
Polyvinyl chloride	750-1,000
Polyurethane	75-100
Nylon	60-75
Total	6,885-8,175

— European Chemical News

FDA CLEARS JM DRUG

Johnson Matthey's new platinum-based anticancer drug **Carboplatin** has been approved in the US by the Food and Drug Administration for use in treating recurrent ovarian cancer. It will be marketed by Bristol-Myers oncology division under the trade name **Paraplatin.**

According to Johnson Matthey the drug is less toxic than its predecessor, **Cisplatin**. Clinical trials on **Carboplatin** were completed in 1985 and the drug was first approved for use in the UK in 1986. Since then it has been approved in Canada and several Euroean countries.

FORMOSA INVESTS IN THE ENVIRONMENT

Taiwan s Formosa group is earmarking Taiwan$1.61bn ($62.7m) for environmental protection: Of the projected investment, the group plans to use Taiwan$1.3bn to buy air pollution control technology and equipment. The whole project is expected to be completed by the end of next year.

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MARKET INFORMATION

IPA shoots, Acrylamide eases

Acrylamide eased to Rs. 86 per kg from Rs. 100/- on account of easy availability. IPA went up by Rs. 4/- to Rs. 44/kg, following short supplies from NOCIL. Rangolite (Czech.) shot up further by Rs. 8/- to Rs. 78/kg, following acute shortage. Adipic acid also shot up to Rs. 70/- following lack of imported materials. Methanol eased by Rs. 2 to Rs. 11 /kg. In the intermediates section, aniline based chemicals went up.

We cannot guarantee the accuracy of the prices published in CHEMICAL WEEKLY as they are based only on the enquiries made by our correspondent -- and, as such they are not FIRM PRICES as between a buyer and seller. The prices are published only with a view to giving some ideas of the market conditions.

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Barium carbonate	6.00
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Borax (Powder)	15.25
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Caustic soda (Solid)	12.00
Caustic soda (Lye)	10.00
Calcium chloride 70% (Solid)	3.25
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Calcium chloride 36% (Anhydrous)	5.00
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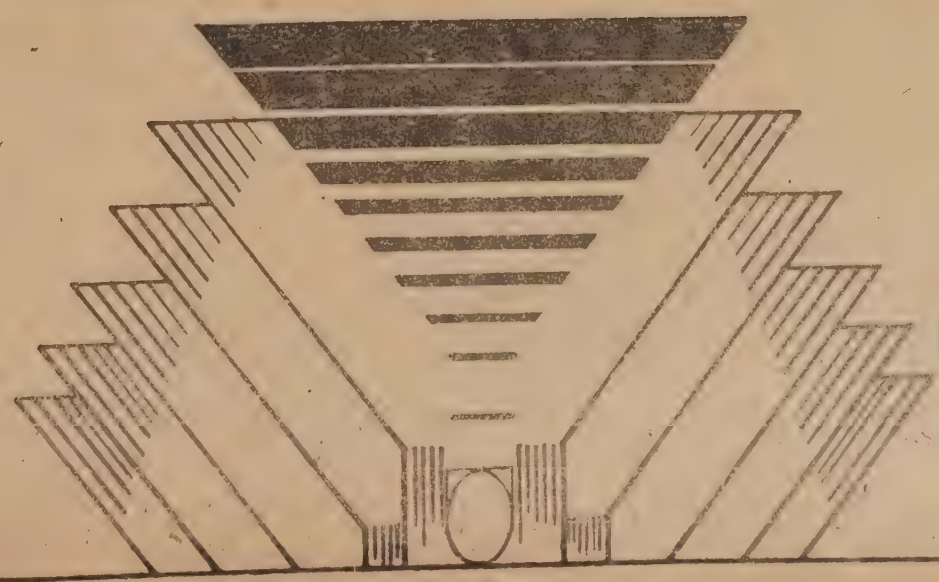

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MPD (Japan)	250.00
Naphthenic Acid	40.00
N-Methyl J. Acid	620.00
N-Methyl Aniline	160.00
Naphthalene (Refined)	21.00
Ortho Anisidine (OA) (Imp.)	110.00
Ortho Dichloro Benzene (ODCB)	16.00
OT Base	120.00
Para Dichloro Benzene (PDCB)	27.00
Para Anisidine (PA local)	155.00
PNA	112.00
Para Cresidine (Imp.)	400.00
Para Amino Azo Benzene (India)	190.00
PNCB	53.00
Para Amino Acetanilide	170.00
1-Phenyl 3-Methyl 5-Pyrazolone	150.00
Phenyl J. Acid	375.00
Para Amino Benzoic Acid	135.00
PT Base	155.00
Rhoduline Acid	530.00
Resist Salt 80%	34.00
Resorcinol	210.00
Sodium Naphthionate	67.00
5-Sulpho-Anthranilic Acid	82.00
Sulphanilic Acid	52.00
Sulpho Tobias Acid	165.00
Trichloro Benzene (TCB)	22.00
Tobias Acid	165.00
Metanilic Acid	44.00
MTD	120.00

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Bombay Dyes Market

(Prices as on September 13, 1989)

ACID COLOURS	Per Kg.
Acid Violet 4BS	*190.00
Acid Maroon V	110.00
Acid Orange II	112.55
Acid Orange IIY	93.85
Acid Red A	137.00
Acid Scarlet 3R	128.35
Acid Red 3BN	*195.00
Acid Red R2R	132.00
Acid Red RS	88.00
Acid Patent Blue AS	*280.00
Acid Green V	*375.00
Acid Coomasi Blue	200.00
Acid Yellow 5GN	65.00
Acid Red PG	85.00
Acid Red GRS	78.00
Acid Black 10 BX	157.15
Acid Black BX	126.95
Acid Black Wax	135.50
Crosein Scarlet MOO	200.30
Procinil Yellow GS (ICI, UK)	265.00
Procinil Red GS (ICI, UK)	530.00
Procinil Blue RS (ICI, UK)	315.00
Procinil Scarlet G (ICI, UK)	600.00
Procinil Orange G (ICI, UK)	250.00
Procinil Rubine (ICI, UK)	550.00

* To get resale price add 6% tax.

DIRECT COLOURS	Per Kg.
Yellow 3GX	114.00
Gun Yellow RCH	175.85
Fast Yellow GCH	171.50
Yellow CFG Hly. Conc.	721.00
Fast Yellow GS	126.96
Fast Yellow CHRS	116.85
Viscose Orange A	210.35
Fast Orange GR	171.50
Red	122.65
Dark Tan	98.15
Red IIR	98.15
Red 4B	217.55
Bordeaux BW	170.10
Fast Scarlet 4BS	223.50
Red 12B	220.45
Bordeaux Hly. Conc.	249.20
Cotton Red N	117.05
Brill. Fast Helio B	362.85
Brill. Fast Helio 2R	385.85
Brill. Fast Helio 2RS	177.30
Brill. Fast Helio BS	116.10
Brill. Violet Extra	181.45
Blue 2B	102.50
Blue G	220.45
Sky Blue FB	242.00
Copper Blue GR	190.25
Fast Greenish Blue GL	114.60
Developed Black BT	149.95
Blue NB-2B	348.45
Blue NB-2BG	214.70
Developed Black NB-GHB	214.70
Green B	142.75
Green NB-B	218.90
Green 2B-N	218.90
Brown MR	197.40
Brown CN	137.00
Golden Brown G	175.85
Catechin G	155.70
Omega Tan	161.45
Catechin GS	102.80
Black E Hly. Conc.	180.15
Black E Extra Hly. Conc.	180.15
Black NB-ER Hly. Conc.	290.50

DISPERSOL COLOURS	Per Kg.
Red B 3B Conc	611.50
Red B 2B Conc	797.90
Red CB Powder	1048.25
Red D2B Powder	589.85
Violet C 4R Conc.	1202.70
Blue BG Conc	580.65
Blue BN Powder	128.20
Blue D 2R Powder	588.25
Navy BT Conc	531.95
Blue B 2G Conc	577.95
Black BT Conc	319.50
Blue BR	482.40
Yellow 7GL	813.20
Yellow 5RX	269.90
Yellow 3G	473.20
Yellow	140.00
Yellow AL	167.20
Yellow Brown REL	311.70
Yellow FFL	571.40
Gold Yellow GG	320.80
Pink REL	593.00
Red REL	615.60
Red 2B	422.40
Red FB	425.80
Red Violet FBL	622.00
Orange 3R	254.20
Violet 3R	370.50
Violet RL	355.70
Violet 6R	638.20
Scarlet RR	283.50
Rubine 3B	289.10
Rubine CB	449.50
Blue GL	419.00
Blue BGF	805.80
Navy Blue RE	359.90
Brown 3REL	272.80
Black GEL	420.10
Dark Brown 3B	411.10

BASE COLOURS	Per Kg.
Fast Yellow GC	77.75
Fast Orange GC	128.40
Fast Scarlet R	198.05
Fast Scarlet RC	128.40
Fast Scarlet RCR	105.60
Fast Scarlet G	115.75
Fast Scarlet GN	92.95
Fast Scarlet GG	77.75
Fast Scarlet GGS	73.95
Fast Red B	233.50
Fast Red RC	115.75
Fast Red R Flakes	158.80
Fast Red TR	181.60
Fast Red TR Oil	223.35
Fast Red RL	251.20
Fast Red KB Oil	251.20
Fast Bordeaux GP	236.00
Fast Garnet GBC	103.05
Fast Violet B	548.80
Fast Blue BB	566.50

NAPHTHOL COLOURS	Per Kg.
ASG	301.85
AS	205.65
ASSW	379.10
ASBS	253.75
ASBO	266.40
ASD	209.45
ASOL	243.60

ASTR	369.00
ASPH	336.05
ASE	236.00
ASEL	249.95
ASLB	2002.35
ASBT	2459.45
ASWG	143.00
ASSG	538.65
ASSR	652.60

PROCION COLOURS	Per Kg.
Golden Yellow HR	207.95
Brill. Yellow H4G	145.65
Supra Yellow H-8GP	168.55
Brill. Yellow HE6G	214.75
Yellow G-E4R	276.05
Brill. Yellow H7G	332.30
Yellow M4R	275.45
Yellow MGR	387.65
Brill. Yellow M4G	201.15
Brill. Yellow M8G	366.10
Yellow M3R	244.70
Brill. Orange H2R	303.80
Brill. Red H7B	157.95
Brill. Orange M2R	313.15
Brill. Red H8B	213.55
Brill. Scarlet H RN	245.05
Supra Red H-3BP	179.80
Brill. Red H-F3B	243.45
Brill. Magenta HB	182.00
Brill. Red M 5B	160.05
Brill. Red M 8B	218.35
Brill. Pink MB	137.10
Brill. Magenta MB	163.65
Brill. Purple H-3R	219.55
Brill. Purple H-7R	175.40
Navy Blue H 3R	333.75
Brill. Blue H-GR	406.40
Brill. Blue H5G	207.95
Blue H 5RX	286.20
Brill. Blue H 7G	213.95
Brill. Blue H 7RX	358.15
Turquoise HA	265.05
Supra Blue H-3RP	595.30
Supra Turquoise H 2G P	181.50
Blue H-FRD	305.80
Navy Blue H3R	333.75
Blue H 5RX	286.20
Navy Blue M3R	355.70
Brill. Blue MR	405.60
Brill. Blue M RX	214.20
Brill. Blue M-G	226.45
Blue M 4GD	369.40
Navy Blue M RB	341.85
Turquoise M-G	240.30
Brill. Blue M GX	516.25
Blue 3R Acra Powder	718.20
Dark Brown H 6R	248.45
Cobalt Oxide	285.00
Green H4BD	287.00
Green H-E4BI	169.80
Red Brown H IF	143.25
Orange Brown H 28	209.05
Brown M GRN	188.80
Black H-N	314.20

SULPHUR COLOURS	Per Kg.
Navy Blue	210.35
Green G	194.55
Black Grains Extra	72.25
Black Grains OG	73.70
Black GXE Conc.	70.85
Black GXE	57.90
Black GXR	69.40
Black Grains 800	62.80
Black EXR Grains	73.70
Black EXR Grains 800	59.35

VAT COLOURS (ICI)	Per Kg.
Yellow 5G Supra Disperse	561.85
Yellow 5G Acra Conc	818.60
Gold Orange 3G Pdr. Fine	1158.45
Brill. Orange 6R Pdr. Fine	624.35
Gold Orange 3G Supra Disp	693.85
Brill. Orange 6RX Powder	394.30
Brill. Red 3B Pdr. Fine	1214.15
Brill. Red 3B Supra Disp	867.45
Brill. Purple 3R Acra Powder	867.45
Brill. Purple 2R Hly Conc.	744.25
Brill. Purple 4R Supra Disp.	604.25
Brill. Purple 2R Acra Conc.	779.85
Blue 2R Powder Fine	675.30
Blue BC Acra Con Pdr. Fine	1013.15
Blue BC Conc. Pdr. Fine	713.65
Blue R Conc. Pdr. Fine	719.70
Blue Conc. Powder	645.80
Brill. Blue 2R Hly. Conc.	378.55
Blue RR Supra Powder	629.35
Brill. Blue 2R Supra Disp.	115.65
Dark Blue 2R Powder Fine	512.65
Blue BC Supra Disp.	419.65
Jade Green XBN Powder Fine	555.80
Jade Green XBN Acra Conc. Pdr	1026.05
Jade Green 2G Pdr. Fine	533.25
Jade Green 2G Ptg. Paste	125.40
Jade Green XBN Ptg. Paste	126.00
Jade Green 2G Supra Disp.	618.00
Olive D Pdr. Fine	563.90
Olive Green B Supra Disp.	421.70
Jade Green XBN Supra Disp. (N)	327.30
Olive OMW Powder Fine	698.55
Olive OMW Supra Disp.	538.05
Olive D Supra Disp.	361.70
Olive R Supra Disp.	470.25
Olive D. Ptg. Paste	193.00
Olive Green B Ptg. Paste	199.10
Olive Green B Acra Conc.	741.10
Olive R Acra Conc.	779.85
Brown R Pdr. Fine	869.45
Dark Brown 3R Fine	826.25
Brown G Supra Disp.	582.05
Brown 2G Supra Disp.	716.10
Brown R Supra Disp.	547.35
Brown BR Powder	867.75
Dark Brown 3R Ptg. Paste	217.15
Dark Brown 3R Supra Disp.	529.60
Brown G Acra Conc.	967.95
Brown M. Powder Fine	768.80
Grey M. Supra Disp.	585.45
Blue BC Acra Conc. Pdr. Fine	762.70
Direct Black AC Supra Disp.	415.75
Direct Black AC Pdr. Fine	574.70
Direct Black CH Supra Disp	490.45
Direct ACD Ptg. Paste	217.15

Delhi Market

DELHI: SEPT. 8 (NNS) Chatkolite and Rangolite Germany jumped up sharply by Rs. 8 at Rs. 78 and Rs. 90 per kg. respectively in the Delhi chemical market during the week in the absence of stock as well as fall in fresh import from China and Germany. In the face of poor supply by manufacturers sufolite flared up from Rs. 70 to Rs. 76 owing to sustained demand shown by gur and khandsari manufacturers. In the absence of fresh offerings as well as increased demand caustic soda flakes advanced by Rs. 15 at Rs. 570/575. Paraffin wax looked up by Rs. 15 at Rs. 865 per 50 kg. due to keen demand from candle manufacturers and dwindling supply. Slack wax registered a rise of Rs. 200 at Rs. 9,700/ton. Sodium silicate went up Rs. 25/50 at Rs. 275/350 due to paucity of supply.

As a result of improved supply and fall in demand by consumers boric acid technical and mercury dropped sharply by Rs. 75 and Rs. 100 at Rs. 1425 and Rs. 11,500. Borax granular and crystal moved down by Rs. 5/10 on good stock position. In the face of better supply of imported goods citric acid small drifted lower by Rs. 50 at Rs. 2175 while citric acid bold of Bombay Dyeing held steady at Rs. 2500. Camphor thal declined by Rs. 2 at Rs. 112 on account of increased supply while camphor powder ruled at Rs. 103 per kg. Menthol flake, medium and bold slipped from Rs. 340, Rs. 380 and Rs. 400 to Rs. 320, Rs. 350 and Rs. 375/kg. resp. on account of increased selling pressure due to poor enquiries by exporters. Menthol flake September and Diwali delivery rose from Rs. 352 and Rs. 370 to Rs. 375 and Rs. 385 on speculative demand but later owing to nervous offerings, declined sharply and quoted at Rs. 352 and Rs. 340 at the weekend.

Mentha oil moved down from Rs. 250/260 to Rs. 220/230 per kg. After a marginal up and down, prices of DMO ruled quiet at their previous level of Rs. 110 per kg. As a result of acute shortage of raw material acid slurry soft and hard looked up by Rs. 1/2 at Rs. 25 and Rs. 36/kg. In the absence of good demand carbon tetrachloride softened by 40 paisa per kg. In the absence of fresh arrivals from Kerala and reports of about 20-25 tons of the commodities purchased by paint and plastic units, titanium dioxide anatase, RC-822 and RCR-2 moved up by Rs. 1/5.

(DELHI MARKET RATES AS ON SEPTEMBER 8, 1989)

Ammonia Bicarb (Per 25 Kg.)	150.00
Mercury (Per flask)	11,500.00
Soda ash (Per bag)	335/355.00
Ammonium Chloride (50 Kg.)	110/180.00
Caustic soda flakes (50 Kg.)	570/575.00
Citric acid (Per 50 Kg.)	2,175/2,500.00
Stable Bleaching Powder Shriram (Per 25 Kg.)	100.00
Stable Bleaching Powder KCl (Per 25 Kg.)	95.00
Stable Bleaching Powder Maruti (Per 25 Kg.)	90.00
Stable Bleaching Powder Modi (Per 25 Kg.)	98.00
Sodium Bicarbonate (50 Kg.)	290/300.00
Sodium Hydrosulphite (Per Kg.)	34.00/36.50
Rangolite (Per Kg.)	70.00/90.00
Boric acid Technical (Per 50 Kg.)	1,425.00
Paraffin Wax (Per 50 Kg.)	865.00
Tartaric Acid (Per 50 Kg.)	12,000.00
Borax Granular (Per 50 Kg.)	700.00
Borax Crystal (Per 50 Kg.)	710.00
Sodium Nitrite (Per 50 Kg.)	700/760.00
Sodium Nitrate (Per 50 Kg.)	425.00
Camphor Thal (Per Kg.)	112.00
Camphor Powder (Per Kg.)	103.00
Menthol Bold (Per Kg.)	375.00
Menthol Medium (Per Kg.)	350.00
Menthol Flake (Per Kg.)	320.00
Glycerine (Per Kg.)	55/58.00
Sodium Silicate (Per quintal)	275/350.00
Hexamine (Per Kg.)	33.50
Acetic Acid Glacial (Per Kg.)	14.50
Copper Sulphate (Per quintal)	2,350/2,700
Formic Acid (Per Kg.)	25.00
Formaldehyde (Per Kg.)	8.50
Hydrogen Peroxide (Per Kg.)	27.50
Calcium Carbonate (Per Tonne)	2,500/4,000
Acid Slurry Soft (Per Kg.)	25.00
Acid Slurry Hard (Per Kg.)	36.00
Phosphoric Acid (Per 50 Kg.)	1,025.00
Potassium Nitrate (Per quintal)	900/1,200.00
Potassium Permanganate (Per 50 Kg.)	2,800/3,200.00
Sodium Bichromate (Per 50 Kg.)	1,575/1,600.00
Trisodium Phosphate (50 Kg.)	490.00
Titanium Dioxide Anatase (Per Kg.)	111.00
Titanium Dioxide RC-822 (Per Kg.)	150.00
Titanium Dioxide K-Brand (Per Kg.)	100.00
Titanium Dioxide RCR-2 (Per Kg.)	150.00
Zinc Oxide (Per metric tonne)	42,000/52,000.00
Phenol Carbolic Acid (Per Kg.)	37.00
Carbon Tetrachloride (Per Kg.)	24.25
Chloroform (Per Kg.)	28.00
Sodium Sulphate (Per metric tonne)	3,250/3,600.00
Naphthalene Balls (Per 50 Kg.)	1,325.00

DYES & COLOURS	(Per Kg.)
Naphthol AS	175/201.65
Naphthol ASG	180/295.20
Naphthol ASBS	210/248.45
Naphthol ASTR	265/360.45
Naphthol ASOL	210/238.60
Naphthol ASBO	195/260.75

DIRECT DYES	(Per Kg.)
Black E. Conc.	110/176.90
Diazo Black B.T.	105/147.55
Green B	90/140.55
Blue 2-B	60/101.40
Blue 2-B 225% (JNR)	125.00
Sky Blue FB	160/235.05
Basic Auramine	55/110.00
Basic Rhodamine	300/425.00
Basic Methylene Blue	100/180.00
Basic Violet	150/180.00
Basic Malachite Green	150/165.00
Acid Orange	75/111.20
Congo Red H/C	75/120.95

Madras Market

Not much activity has been reported in the market. Soda ash prices reacted due to non-arrivals of supplies from TAC as well as Gujarat producers for the past few days. Though prices of Mettur's caustic soda flakes and Andhra Sugars's caustic flakes' prices were firm at Rs. 610/per bag of 50 kgs, prices of other makers were available at lower prices around Rs. 590/per bag of 50 kgs. Titanium dioxide prices went down by Rs. 20/- to Rs. 105/per kg. on account of marginally better availability compared to the hard times when prices reached peak levels.

Aniline oil prices shot up and it was practically not available. Bulk drug items like analgin and paracetamol prices are going up steadily due to non-availablity of intermediary items that go into their manufacture.

(MADRAS MARKET RATES AS ON SEPTEMBER 9, 1989)

Acetic Acid Glacial (per kg)	16.50
Aluminium Sulphate Iron free (per MT)	3,750.00
Ammonium Bicarbonate (per 25 kgs)	135.00
Ammonium Chloride (per MT)	3,000.00
Acid Slurry (per kg)	30.00
Barium Carbonate (per kg)	6.50
Barium Chloride (per kg)	5.50
Boric Acid Technical (per kg)	24.00
Bleaching Powder (per 50 kgs)	245.00
Borax (per 50 kgs)	685.00
Caustic Soda Flakes – Mettur Chemicals (per MT)	12,200.00
Caustic Soda Flakes – Andhra Sugars (per MT)	12,200.00
Calcium Chloride 70% Solid (per MT)	3,000.00
Calcium Chloride Anhydrous (per MT)	5,750.00
Calcium Carbonate (Activated) (per MT)	5,750.00
Calcium Carbonate (Precipitated) (per MT)	4,750.00
Citric Acid (per kg)	48.00
Copper Sulphate (per kg)	24.00
Cresylic Acid 98-99% (per kg)	125.00
Pure Para Cresol 96% (per kg)	80.00
Meta Para Cresol 42% (per kg)	52.00
Formic Acid (per kg)	27.00
Formaldehyde (per kg)	8.00
Glue Flakes (per kg)	15.00
Glycerine (per kg)	48.00
Hydrosulphite of Soda (TCPL) (per kg)	37.00
Hydrosulphite of Soda (IDI) (per kg)	40.00
Hydrosulphite of Soda (BASF) (per kg)	42.00
Hexamine (per kg)	29.00
Hyflo Supercell (per kg)	20.00
Hydrogen Peroxide (per kg)	30.00
Litharge (per kg)	42.00
Lead Acetate (per kg)	42.00
Magnesium Carbonate (per kg)	19.50
Magnesium Chloride (per kg)	3.50
Maleic Anhydride (per kg)	39.00
Menthol Crystals (per kg)	400.00
Oxalic Acid (per kg)	24.00
Paraffin Wax (per kg)	20.00
Potassium Bichromate (per kg)	36.00
Phosphoric Acid (per kg)	22.00
Polyvinyl Alcohol powder (per kg)	125.00
Pentaerythritol (per kg)	50.00
Phthalic Anhydride (per kg)	28.00
Soda Ash (TAC) (per 75 kgs)	395.00
Soda Ash (TATA) (per 75 kgs)	395.00
Sodium Bicarbonate (TATA) (per 50 kgs)	380.00
Sodium Silicate (per MT)	3,500.00
Sodium Bichromate (per kg)	28.00
Sodium Nitrate (per kg)	8.00
Sodium Nitrite (per kg)	15.50
Sodium Sulphide Flakes (per kg)	12.00
Sodium Bisulphite (per kg)	4.50
Sodium Alginate (per kg)	210.00
Sodium Acetate (per kg)	7.50
Sodium Sulphate (Anhydrous) (per kg)	3.00
Titanium Dioxide (Anatase) (per kg)	105.00
Titanium Dioxide (Rutile) (per kg)	125.00
Trisodium Phosphate (per kg)	12.00
Urea (Technical) (per kg)	3.00
Zinc Oxide (per kg)	54.00
Zinc Chloride Powder (per kg)	12.50
Zinc Sulphate (per kg)	6.50

SOLVENTS

Acetone -- HOCL (per kg)	20.00
Butanol (per kg)	36.00
Butyl Acetate (per kg)	42.00
Benzene (per lit)	17.00
Cellosolve (per kg)	50.00
Carbon Tetra Chloride (per kg)	23.00
Chloroform (per kg)	28.00
Diacetone Alcohol (per kg)	30.00
Diethylene Glycol (per kg)	50.00
Dichloroethane (per kg)	17.00
Di-octyl Phthalate (per kg)	49.00
Di-N-butyl Phthalate (per kg)	50.00
Ethyl Acetate (per kg)	22.00
Isopropyl Alcohol (per kg)	30.00
Methanol (per kg)	10.00
Methylene Chloride (per kg)	22.50
Methyl Ethyl Ketone (per kg)	40.00
Methyl Isobutyl Ketone (per kg)	50.00
Phenol (per kg)	40.00
Sorbitol (per kg)	15.00
Triethanolamine (per kg)	60.00
Trichloroethylene (per kg)	25.00
1-1-1 Trichloroethane (per kg)	27.00
Turpentine (per lit)	17.50
Toluene (per lit)	20.00
Xylene (per lit)	22.00

Shipping News

VESSELS DUE IN BOMBAY FOR EXPORT LOADING

Due Date (1)	Steamer's Name & Flag (2)	Agents (3)	Will load for (4)	Approx. sailing dt. (5)
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16/9	Paithoon (V-28)	Samrat/	Longbeach; Oakland; Seattle; Los Angeles; Sanfrancisco; Philadelphia; Savannah; Charleston; Baltimore; Norfolk; New York; Boston; St. John; Vancouver; Montreal; Toronto; New Orleans; Houston. (Carting at M.B.).	21/9
		U.L.A./	Los Angeles; Sanfrancisco; Oakland; Seattle; Vancouver; Charleston; Houston; Norfolk; Baltimore; New York; Halifax; Montreal; Toronto; S. American and West Indies Ports. (Carting at M-171/173 C.D.).	
		E.S.P.L./	Longbeach; Charleston; New York; St. John; Norfolk; Oakland; Vancouver (B.C.); Seattle; Montreal; Baltimore; Boston; Chicago; Dallas; Houston; Longview; Los Angeles; New Orleans; Philadelphia; Portland; San Diego; Mexico City; Sanfrancisco; Siouxfall; Sacramento; Stockton; Halifax; Toronto; Savannah; Tocoma; Miami and all other destinations. Also Caribbean ports. (Carting at M.B.).	
		Trident/	S. American; Caribbean and Central American Ports. (Carting at 7-W/H-PD).	
		Arebee	S. American Ports. (Carting at M-Jetha Cotton Depot).	
20/9	Maersk Clementine (Sing)(V-8930)	Volkart Fleming	New York; Philadelphia; Baltimore; Norfolk; Chaleston; Savannah; Jacksonville; Miami; New Orleans; Houston; Toronto; Montreal; Chicago; Atlanta; Denver; Dallas; Wilmington; Milwaukee; Detroit; Minneapolis; Memphis; Nashville; Cleveland; Phoenix; Boston; Los Angeles; Vancouver; Seattle; Sanfrancisco; Portland; Longbeach; Mexican & S. American ports. (Carting at M.O.D. No. 2).	25/9
15/9	Orient Triumph (Cyp) (Voy-313)	Transworld	Los Angeles; Longbeach; Sanfrancisco; Oakland; Seattle; Vancouver; New York; Boston; Toronto; Montreal; Philadelphia; Norfolk; Baltimore; Charleston; Savannah; Jacksonville; Miami; New Orleans; Houston. (Carting at CFS Cotton Avenue).	20/9
18/9	Medipas Wave	Samrat/ Hindustan	Boston; New York; Baltimore; Norfolk; Charleston; P. Mouth; P. Lauderdale; Miami; New Orleans; Savannah; Jacksonville; P. Everglades; Philadelphia; Halifax; Montreal; Toronto and S. American ports. (Carting at M.O.D. No. 1 for both).	22/9
16/9	Uni Pioneer (Voy-013)	Greenways	New York; Newark; Baltimore; Charleston; New Orleans; Houston; Boston; Providence (RI); Philadelphia; Norfolk; Savannah; Jacksonville; Wilmington; Miami; Montreal; Toronto; Bermuda; Los Angeles; Longbeach; Sanfrancisco; Oakland; San Diego; Stockton; Richmond; Almeida; Redwood City; Sacramento; Seattle; Portland; Vancouver (B.C.); Tacoma; Longview; Chicago; Dallas; Various inland destinations and Caribbean ports. (Carting at G/H Cotton Depot).	22/9
22/9	Kabirdas (Ind)	S.C.I.	New York; Baltimore; Savannah (Direct) and other inland destinations. (Carting at Timber Pond No. 1).	27/9
16/9	Thompson Lykes	S.W.& Co.	U.S.A. Gulf	20/9
16/9	Paithoon	U.L.A/ Trident	Lagos/Apapa; Abidjan; Lome/Matadi. (Carting at M-171/173 C.D.).	21/9
			Tema/Lome; Lagos; Matadi; Lobito; Luanda; Freetown; Cotonou; Douala; P. Harcourt; Abidjan; Monrovia; Dakar. (Crtg. at 7-W/H-PD).	
20/9	Maersk Clementine	V. Fleming	Lagos/Apapa; Dakar; Freetown; Monrovia; Lome; Cotonou; Douala; Tema. (Carting at M.O.D. No. 2).	25/9
15/9	Orient Triumph	Transworld	Monrovia; Lome; Lagos; Douala; Tema; Takordi; Abidjan; San Pedro. (Carting at CFS Cotton Avenue).	20/9
18/9	Medipas Wave	L. Triest	With T.P. Lagos/Apapa; Abidjan; Dakar; Douala; Cotonou; Nouakchott; Liberville; Tema; Matadi; Conakry; Freetown. (Carting at M-171/173 C.D.)	22/9
18/9	Lanka Asitha (Lib)	Seahorse	Hodeidah; Jeddah; Aqaba; Alexandria (Direct); Felixstowe; London; Liverpool; Manchester; Avonmouth; Dublin; Glasgow; Wembly; Leicester; Immingham; Birmingham; Leeds; Antwerp; Bremen; Copenhagen; Gothenburg; Hamburg; Rotterdam; Oslo; Stavanger; Aarhus; Malmao; Norkopping. (Carting at M.O.D. No. 1)	22/9

(1)	(2)	(3)	(4)	(5)
20/9	Maersk Clementine	Volkart Fleming	Leghorn; Marseilles; Naples; Barcelona; Bilbao; Bordeaus; Alicante; Genoa; Valencia; Bremen; Jeddah; Antwerp; Rotterdam; Bremerhaven; Hamburg; U.K. and Scandinavian ports. (Carting at M.O.D. No. 3).	25/9
15/9	Orient Triumph (Cyp) (Voy-313)	Transworld	Djibouti; Hodeidah; Alexandria; Benghazi; Tripoli; Malta; La Spezia; Mersin; Naples; Limassol; Piraeus; Genoa; Leghorn; Fos; Valencia and all inland destinations; Jeddah; P. Sudan; Assab; Massawaa. (Carting at CFS Avenue).	20/9
18/9	Zhitomir (Nhava Sheva)	Transocean	Odessa; Illychevsk; Havana; (Cuba); Genoa; Trieste; Piraeus; Marseilles; Barcelona; Varna; Bourgas. (Carting at CFS).	20/9
18/9	Medipas Wave (Cyp)	L. Triest/	Jeddah; Barcelona; Marseilles; Genoa; Leghorn; La Spezia; Naples; with TP Trieste; Venice; Ravenna; Bari; Koper; Rijeka; Las Palmas; Santacruz; De Teneriffe; Malta; Limmassol; Alexandria; Casablanca; Tunis; Algiers; Latakia; Tripoli; Benghazi; Oran; Point E Pitre; Port De France. (Carting at M-171/173 Cotton Depot).	22/9
		Samrat/ Hindustan/	Barcelona; Marseilles; La Spezia; Livorna; (Leghorn): Genoa; Naples other Italian ports and FCL only Beirut; Alexandria; Valletta; Lattakia; Mersin. (Carting at M.O.D. No. 1 for both).	
		Merzario	Genoa; Leghorn; La Spezia; Naples; Salerno; Marseilles; Barcelona. (Carting at M.O.D. No. 2).	
16/9	Uni Pioneer (V-013)(Pan)	Greenways	Hamburg; Felixstowe; Rotterdam; Antwerp; Le Havre; London; Liverpool; Leixoes; Lisbon; Manchester; Avonmouth; Wembly; Birmingham; Leeds; Leicester; Amsterdam; Bremen; Copenhagen; Aarhus; Gothenburg; Oslo; Stockholm; Helsinki; Belfast and all destinations in U.K.; Germany; Switzerland and Austria. (Carting at G/H Cotton depot).	22/9
20/9	Navigare (V-709)	Killick	Jeddah; Felixstowe; London; Liverpool; Manchester; Bristol; Avonmouth; Leeds; Glasgow; Tilbury; Birmingham; Dublin; Belfast; Rotterdam; Hamburg; Le Havre; Antwerp; Bremen; Bremerhaven; Fos; Valencia; Marseilles; Barcelona. (Carting at M-178/180 C.D.).	25/9
22/9	Kabirdas	S.C.I.	Felixstowe; Hamburg; Rotterdam; Antwerp; Bremen; Liverpool; Le Havre; Manchester; Avonmouth; London; Belfast; Aarhus; Oslo; Copenhagen; Gothenburg; Helsinki and all inland destinations. (Carting at Timber Pond No. 1).	27/9
18/9	Lanka Asitha	Seahorse	Colombo. (Carting at M.O.D. No. 3).	22/9
16/9	Paithoon	Silvership	Chittagong. (Carting at 19-ID)	21/9
18/9	Zhitomir	Transocean	Afghanistan. (Carting at CFS)	20/9
18/9	Medipas Wave	L. Triest	Colombo. (Carting at 171/173 Cotton Depot).	22/9
18/9	Lanka Asitha	Seahorse	Singapore; Penang; P. Kelang; Bangkok; Hongkong; Keelung; Kobe; Yokohama and FCL only Busan; Inchon; Osaka; Tokyo; Nagoya; Kaohsiung. (Carting at M.O.D. No. 3).	22/9
16/9	Pathoon (Voy-28)	Samrat/	Singapore (Direct); Penang; Jakarta; Surabaya; Belawan; P. Kelang; Bangkok; Manila; Hongkong; Kaohsiung; Keelung; Taichung; Busan; Yokohama; Nagoya; Kobe; Osaka; Tokyo. (Crtg. at Mallet Bunder).	21/9
		Trident/	Busan; Hongkong; Keelung; Kobe; Nagoya; Yokohama; Penang; P. Kelang; Bangkok; Kaohsiung; Singapore. (Carting at 7-W/H-PD).	
		U.L.A./	Singapore; Penang; P. Kelang; Keelung; Kaohsiung; Bangkok; Busan; Jakarta; Hongkong; Japan & Chinese ports. (Crtg. M-171/173 C.D.).	
		S.S.P.L./	Dalian; Quindao; Tianjin (Xingang); Nawtong; Shanghai; Ningbo; Xiamen; Fuzhou; Guangzhou; Whampoa; Vietnam. (Carting at M.B.).	
		Transworld/	P. Kelang; Penang; Keelung; Kaohsiung; Busan; Bangkok; Kobe; Yokohama; Nagoya; Tokyo; Shimizu. (Carting at M-178/180 C.D.).	
		I.M.E./	Singapore; Bangkok; Hongkong; Keelung; Busan; Kobe; Yokohama; Nagoya. (Carting at Wadi Bunder No. 3).	
		Silver Ship	Singapore; Far East and Japan ports. (Carting at 19-ID).	
20/9	Maersk Clementine (Sing)(V-8930)	Volkart Fleming	Penang; Singapore; Hongkong; Keelung; Kaohsiung; Busan; Main Japan Ports; Manila; Jakarta; Surabaya; Bangkok; P. Kelang; Chinese Ports. (Carting at M.O.D. No. 2).	25/9
16/9	S/o Tripura (Ind)	S.C.I.	Main Japan ports.	27/9
16/9	Uni Pioneer (V-013)(Pan)	Greenways	Singapore; Penang; Port Kelang; Bangkok; Djakarta; Surabaya; Manila; Cebu; Kaohsiung; Keelung; Osaka; Yokohama; Kobe; Shimizu; Moji; Nagoya; Pusan; Hongkong. (Carting at G/H Cotton Depot).	22/9
18/9	Lanka Asitha	Seahorse	Brisbane; Fremantle; Sydney; Melbourne; Adelaide. (Crtg MOD No. 3)	22/9

(1)	(2)	(3)	(4)	(5)
16/9	Pathoon	Samrat/	Brisbane; Sydney; Melbourne; Adelaide; Fremantle; Burnie. (Carting at Mallet Bunder).	21/9
		Trident/	Brisbane; Sydney; Melbourne; Adelaide; Fremantle; Burnie; Auckland; Wellington; Lyttelton. (Carting at 7-W/H-ID).	
		Arebee/	Sydney; Melbourne; Adelaide; Brisbane. (Carting at M-Jetha C.D.).	
		Transworld/	Sydney; Melbourne; Adelaide; Fremantle; Burnie; Brisbane. (Carting at M-178/180 Cotton Depot).	
		Kanika/	Brisbane; Sydney; Melbourne; New Castle; Adelaide; Fremantle; Auckland; Wellington; Lyttleton. (Carting at Timber Pond No. 3).	
		Silver Ship	Sydney; Melbourne; Brisbane; Adelaide; Fremantle; Auckland; Wellington; Lyttelton; P. Chalmers. (Carting at 19-ID).	
18/9	Lanka Asitha	Seahorse	Dubai; Khorfakkan; Sharjah; Muscat; Dammam; Riyadh; Kuwait. (Carting at M.O.D. No. 3).	22/9
20/9	Maersk Clementine	V. Fleming	Dubai; Dammam; Muscat; Bahrain; Kuwait; Riyadh; Doha. (Carting at M.O.D. 2).	25/9
15/9	Orient Triumph (V-313) (Cyp)	Transworld/	Sharjah; Dubai; Abu Dhabi; Ajman; Doha; Kuwait; Dammam; Baghdad/ Basrah; Syria and inland destinations in Gulf. (Carting at CFS Cotton Avenue).	20/9
		Sai Ship	Dubai; Muscat; Sharjah; Abu Dhabi. (Carting at Wadi Bunder No. 3)	
15/9	Satguru	H.S.A.	Dubai; Sharjah	25/9

VESSELS DUE IN BOMBAY FOR IMPORT DISCHARGE

Due Date	Steamer's Name	Agents	From
20/9	Jala Mudra	S.C.I.	E. Africa
20/9	Kamatheri	Sai Ship	Mexico
22/9	Kabirdas	S.C.I.	U.K. Cont./U.S.
22/9	Navigare (Voy-709)	Seahorse	U.K. Cont.
21/9	Novmenchu	F.F.C. Co.	U.K. Cont.
25/9	New Sea	Arcadia	Brazil
21/9	Porta Tissa	Sai Ship	S. America

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Materials Imported

BOMBAY
12.5.89
(Contd. from the previous issue)

BROMINE LIQUID: From Israel: J.Kirit & Bros., 11,320 Kgs., Rs. 2,87,300.

CAPTAN TECH: From Israel: Northern Minerals Ltd., 30,000 Kgs., Rs. 15,20,102.

CARBAZOLE 95-97%: From FRG: PDI Chemicals Pvt. Ltd., 2,000 Kgs., Rs. 1,09,123.

CARBON BLACK: From USA: Asian Cables Ltd., 795 Kgs., Rs. 23,274.

O-CHLOROBENZALDEHYDE: From Japan: Yogesh Dyestuff Products Pvt. Ltd., 1,150 Kgs., Rs. 86,862.

CYANURIC CHLORIDE: From FRG: Southern Sea Foods Pvt. Ltd., 9,150 Kgs., Rs. 4,19,712.

DESMODUR T80: From FRG: Cipy Chemicals, 1,000 Kgs., Rs. 37,452.

2 ETHYL HEXANOIC ACID: From Japan: JKB Enterprise, 7,380 Kgs., Rs. 1,16,797.

ETHYL LACTATE: From Netherlands: Punjab Anand Lamps Inds., 1,120 MTs., Rs. 61,433.

ETHYL MERCAPTAN: From Netherlands: Volrho Ltd., 24,960 Kgs., Rs. 5,85,230.

HEXA CHLORO CYCLOPENTADIENE: From USA: Bharat Pulverising Mills Ltd., 80,014 Kgs., Rs. 22,95,346.

HYDROXYLAMINE SULPHATE: From FRG: Apte Amalgamations Ltd., 18,000 Kgs., Rs. 5,06,163.

3-METHYL THIOPHENE: From UK: Kantilal Manilal & Co., 800 Kgs., Rs. 3,48,178.

MONOSODIUM GLUTAMATE 99% MIN.: From France: Rameshkumar, 18,000 Kgs., Rs. 3,82,386.

NOVOLDIAMINE: From FRG: Sharvani Pharmaceuticals Ltd., 1,980 Kgs., Rs. 6,44,203.

POTASSIUM SILICATE: From FRG: Qualitron Components Ltd., 38.753 MTs., Rs. 3,03,323.

PROPYLENE GLYCOL: From Japan: Rallis India Ltd., 16,000 Kgs., Rs. 3,40,000.

PROPYLENE GLYCOL USP: From USA: Raptakos Brett & Co. Ltd., 17,200 Kgs., Rs. 3,78,924.

SODIUM FORMALDEHYDE SULFOXILATE: From Czechoslovakia: Sun Export Corpn., 12,000 Kgs., Rs. 1,81,350.

TITANIUM DIOXIDE: From Australia: Imkemex India Ltd., 20,000 Kgs., Rs. 7,86,804., Goodlass Nerolac Paints Ltd., 60,000 Kgs., Rs. 22,97,-469.

DYE MATERIALS IMPORTED
BOMBAY (12.5.89)

DYESTUFFS: From USA: Reliance Inds. Ltd., 3,000 Kgs., Rs. 33,96,083.

DRUG MATERIALS IMPORTED
BOMBAY (12.5.89)

CHLORHEXIDINE GLUCONATE BP 20%: From Finland: Rallis India Ltd., 180 Kgs., Rs. 21,125.

L-LYSINE MONO HCL USP: From Korea: K. Mansukhlal & Co., 500 Kgs., Rs. 48,388.

SULPHADIAZINE BP 80: From China: C.J. Shah & Co., 250 Kgs., Rs. 51,142.

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HDPE: From Saudi Arabia: Plastics

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International, 17,150 Kgs., Rs. 2,75,270.

PVC RESIN: From Austria: Sintered Separators Ltd., 18,000 Kgs., Rs. 3,96,620; From Turkey: Gujarat State Exports Corpn., 75,000 Kgs., Rs. 14,30,005.

POLYPROPYLENE: From Austria: Coolwels Automobile Engg., 15,750 Kgs., Rs. 3,22,195; Sunil Poly Plast, 84.15 MTs., Rs. 2,32,935.

POLY TETRAFLUORO ETHYLENE: From Netherlands: Poonam Plastics Inds., 2,000 Kgs., Rs. 4,42,020.

POLYVINYL CHLORIDE: From Mexico: Gujarat State Exports, 244.40 MTs., Rs. 52,49,028.

MATERIALS IMPORTED BOMBAY (From 16.5.89 to 17.5.89)

ACRYLIC ACID: From Japan: Aquapharm Chemical Co. Pvt. Ltd., 16,000 Kgs., Rs. 4,72,038.

ACRYLIC ACID 98%: From Japan: Indofil Chemicals Co., 4,000 Kgs., Rs. 1,27,146.

AEROSIL 200: From Belgium: Goodlass Nerolac Paints Ltd., 250 Kgs., Rs. 28,435.

ALUM OXIDE SYNTHETIC: From FRG: Grindwell Norton Ltd., 10,000 Kgs., Rs. 1,42,699.

ATRAZINE TECH: From USA: Rallis India Ltd., 17,280 Kgs., Rs. 7,86,375.

BROMINE LIQUID: From Netherlands: Colour Chem Ltd., 22,680 Kgs., Rs. 5,74,598.

BUTACHLOR TECH 90% MIN: From USA: Herbicides (India) Ltd., 34,920 Lbs., Rs. 7,30,838.

2-BUTENE 1,4 DIOL: From FRG: Lupin Laboratories Ltd., 6,000 Kgs., Rs. 4,57,919.

BUTENEDIOL: From USA: Excel Industries Ltd., 16,374.96 Kgs., Rs. 11,46,663.

PARA TERTIARY BUTYL PHENOL: From USA: R A Chemicals, 7,000 Kgs., Rs. 1,54,213.

CALCIUM OXIDE: From Netherlands: B.M. Thakkar & Co. Pvt. Ltd., 1,000 Kgs., Rs. 11,167.

CAPROLACTUM: From Spain: Modipon Fibres Co., 250 MTs., Rs. 75,82,757.

CELLULOSE ACETATE: From FRG: Shailesh Engg. & Plastic Inds., 6,320 Kgs., Rs. 37,995.

CETYL ALCOHOL: From FRG: Dilipkumar & Co., 4,000 Kgs., Rs. 1,22,553.

CHLORINATED XYLENOLS: From UK: Sodium Metal Pvt. Ltd., 2,000 Kgs., Rs. 67,368.

CINNAMIC ALDEHYDE: From FRG: Charu Perfumery House, 15,600 Kgs., Rs. 7,20,212.

CITRIC ACID: From China Rupesh International, 52.5 MTs. Rs. 8,09,619; Sanjay Trading Corpn., 4 MTs., Rs. 69,238.

CITRIC ACID MONO BP 80: From China: Sanjay Trading Corpn., 4 MTs. Rs. 69,238.

CYANOACETIC ACID METHYL ESTER: From Japan: Colour Chem Ltd., 1,000 Kgs., Rs. 93,643.

DESMODUR: From FRG: Rosy Chemicals, 2,000 Kgs., Rs. 1,08,284.

DESMODUR RF ISOCYANATE: From FRG: Rajendra Polymers Pvt. Ltd., 1.005 MTs., Rs. 1,84,750.

DESMODUR T80: From FRG: Jai Industries, 19,000 Kgs., Rs. 6,47,302.

DESMOPHEN 7186: From Belgium: Jai Industries, 15,480 Kgs., Rs.3,10,582.

DICHLORO ACETYL CHLORIDE: From Japan: Parag Pharmaceuticals India Pvt. Ltd., 1,500 Kgs., Rs. 56,437.

DIMETHYL AMINOETHYL METHACRYLATE: From USA: RSA Polymers, 4,000 Lbs., Rs. 1,48,444.

DIMETHYL FORMAMIDE: From Japan: Mihir Chemicals, 15,200 Kgs.,

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DIMETHYL SULFOXIDE: From USA: Zora Pharma Pvt. Ltd., 17,500 Kgs., Rs. 2,19,833.

DITOLUENE DIISOCYANATE: From USA: Sheela Foam Pvt. Ltd., 38 MTs., Rs. 12,97,594.

2-ETHYL HEXANOIC ACID: From Japan: Modern Chemicals and Plastics, 14,400 Kgs., Rs. 2,23,597.

GLUTAMIC ACID 98% From Taiwan: Eastern Chemical Laboratory, 1,000 Kgs., Rs. 36,036.

GUM ROSIN: From Indonesia: Gem Synthetics & Polymers India, 54 MTs., Rs. 4,37,619.

HEXA CHLORO CYCLOPENTADIENE: From USA: Excel India Ltd., 200.04 MTs., Rs. 59,02,195.

HYDROQUINONE: From Italy: Jainson Apparels Pvt. Ltd., 2,000 Kgs., Rs. 1,00,711.

D-PARA HYDROXY PHENYL GLYCINE METHYL POTASSIUM DANE SALT: From Singapore: Gujarat Lyka Organics Ltd., 1,000 Kgs., Rs. 3,30,457.

IODINE CRUDE: From Belgium: Kirti Chemicals, 5,000 Kgs., Rs. 13,96,550; From China: Eskay Fine Chemicals, 2,000 Kgs., Rs. 6,23,149; From Japan: Eagle Chemical Works, 500 Kgs., Rs. 1,54,056.

IODINE CRUDE 99.5% MIN: From Japan: Calibre Chemicals Pvt. Ltd., 2,000 Kgs., Rs. 6,16,223.

IMIDAZOLE: From FRG: Jal Pvt. Ltd., 1,000 Kgs., Rs. 1,36,746.

LINALOOL: From FRG: Kanta Chemical Co., 500 Kgs., Rs. 69,251.

L-LYSINE MONO HCL: From Korea: Rallis India Ltd., 1,600 Kgs., Rs. 1,52,421.

MANGANESE DIOXIDE OXIDATION: From Belgium: Lupin Laboratories Ltd., 4,700 Kgs., Rs. 2,00,999.

METHACRYLAMIDE: From FRG: Colour Chem Limited, 2,000 Kgs., Rs. 1,67,042.

2 METHOXY 2,3,4H DIHYDROPYRANE: From FRG: BASF India Ltd., 15,000 Kgs., Rs. 7,11,399.

METHYL ETHYL KETONE: From France: Weston Components Ltd., 13,600 Kgs., Rs. 2,62,163; From FRG: Rajasthani Trading Co., 15,200 Kgs., Rs. 2,15,272.

N-METHYL PYRROLE: From FRG: J & F Synthetics Limited, 170 Kgs., Rs. 54,226.

MOLYBDENUM TRIOXIDE: From Japan: Sudarshan Chemical Inds., 1,000 Kgs., Rs. 1,14,086.

MONOCROTOPHOS TECH: From Taiwan: Gujarat State Co-op. Fed., 16,000 Kgs., Rs. 13,09,238.

MONO ETHYLENE GLYCOL: From Japan: Alcon Electronics Pvt. Ltd., 1,125 Kgs., Rs. 51,062; From Saudi Arabia: Modipon Fibres Co., 99,900 Kgs., Rs. 26,19,748.

MONOSODIUM GLUTAMATE 99%: From France: Daffodil Pharmaceuticals Pvt. Ltd., 18 MTs., Rs. 3,82,386.

PARAFORMALDEHYDE: From Spain: Goodlas Nerolac Paints Ltd., 16,000 Kgs., Rs. 1,56,101.

PARAFORMALDEHYDE 91% PRILLS: From Spain: Speciality Chemicals, 13,000 Kgs., Rs.1,02,284.

PHTHALODINITRILE: From FRG: Hindustan Ciba Geigy Ltd., 2,000 Kgs., Rs. 1,63,685.

PIPERAZINE ANHYDROUS: From Belgium: Ranbaxy Laboratories Ltd., 7,200 Kgs., Rs. 5,09,021.

POLYETHER POLYOL: From USA: Tirupati Foams Pvt. Ltd., 16,380 Kgs., Rs. 3,38,692.

POLYVINYL ALCOHOL: From Japan: Blue Blend Leasing Pvt. Ltd., 5

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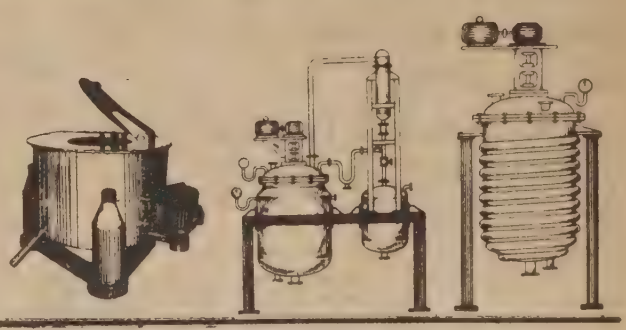

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PROPIONIC ACID: From FRG: Hico Products Ltd., 16,380 Kgs., Rs. 1,99,368.

PROPYLENE GLYCOL TECH: From Japan: Hareshkumar and Co., 16,000 Kgs., Rs. 3,30,154.

PROPYLENE GLYCOL USP: From Japan: Wardex Pharmaceuticals Ltd., 10,500 Kgs., Rs. 2,23,058; From USA: MJ. Exports Ltd., 16,770 Kgs., Rs. 3,29,868.

PYRIDINE BASE 90/160 L: From UK; Southern Sea Foods Pvt. Ltd., 2,660 Kgs., Rs. 93,478.

RESORCINOL: From FRG: Appoorva Impex, 3,000 Kgs., Rs. 2,02,996.

SODIUM METHOXIDE: From FRG: Parag Pharmaceuticals Pvt. Ltd., 1,000 Kgs., Rs.53,303.

SODIUM PICARAMATE: From France: BASF India Ltd., 2,143 Kgs., Rs. 3,36,240.

TETRAHYDROFURAN: From FRG: Merind Limited, 2,700 Kgs., Rs. 1,31,451.

TITANIUM DIOXIDE: From Japan: Goodlass Nerolac Paints Ltd., 17,500 Kgs., Rs. 6,74,682.

TITANIUM DIOXIDE RUTILE: From Japan: IEL Ltd. Chemicals Division, 17,500 Kgs., Rs. 6,88,452; JBA Printing Inks Ltd., 20,000 Kgs., Rs. 8,81,218.

META TOLUENE DIAMINE CRUDE: From Japan: Azo Products, 2,000 Kgs., Rs. 85,999.

TOLUENE DI ISOCYANATE: From Italy: Cheminova Ind. Pvt. Ltd., 19 MTs., Rs. 6,72,716; From USA: Banmure Foam Pvt. Ltd., 19 MTs., Rs. 6,48,797.

TRIMELLITIC ANHYDRIDE: From USA: Dr. Beck & Co. (I) Ltd., 16,330 Kgs., Rs. 5,83,492.

3,4,5 TRIMETHOXY BENZALDEHYDE: From Singapore: Shaba Chemicals Pvt. Ltd., 2,000 Kgs., Rs. 6,32,734.

TRIISOPROPANOLAMINE: From FRG: Hindustan Ciba Geigy Ltd., 200 Kgs., Rs. 33,157.

DRUG MATERIALS IMPORTED BOMBAY (From 16.5.89 To 17.5.89)

D-CALCIUM PANTOTHENATE USP: From Japan: Rallis India Ltd., 500 Kgs., Rs. 1,14,086.

MORPHOLINE: From FRG: General Traders Corpn., 16,000 Kgs., Rs. 4,95,497.

PYRIDOXINE HYDROCHLORIDE USP: From Japan: Dilipkumar and Co., 300 Kgs., Rs. 1,68,030.

PLASTIC MATERIALS IMPORTED BOMBAY (From 16.5.89 to 17.5.89)

HDPE: From Czechoslovakia: Hardik Inds. Corpn., 187.500 MTs., Rs. 20,96,865; From Japan: Shalimar Pack, 50 MTs., Rs. 8,81,218; From Switzerland: Diamond Polyprints, 34,300 Kgs., Rs. 5,96,561; From Saudi Arabia: J.K. Industrial Polymers, 35,234 Kgs., Rs. 3,89,555; Leela Packaging Pvt. Ltd., 102.900 MTs., Rs. 17,81,162; P.X. Laminators, 17,150 Kgs., Rs. 2,99,559; Shah Indl. Corpn., 49.500 MTs., Rs. 7,67,250.

LLDPE: From Netherlands: Essel Packaging Ltd., 30 MTs., Rs.5,95,695.

PVC RESIN: From Korea: Manish Vinyls, 50,000 Kgs., Rs. 10,27,185; From Korea: Royal Cushion Vinyl Products Pvt. Ltd., 50 MTs., Rs. 10,50,262; Vinpepp Enterprises, 25,000 Kgs., Rs. 5,14,346; From Turkey: Oswal Cable Products, 25,000 Kgs., Rs. 4,91,433; From UK: Chloride Inds. Ltd., 28 MTs., Rs. 6,28,235.

POLYACETAL MOULDING POWDER: From FRG: Panorama Computeronics Pvt. Ltd., 34 MTs., Rs. 10,96,802.

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POLYETHYLENE: From FRG: Albert David Ltd., 28 MTs., Rs. 6,22,841; From Japan: C.D. Corporation, 5,000 Kgs., Rs. 1,14,086; From Saudi Arabia: Union Plastics., 17.150 Kgs., Rs. 2,99,559.

POLYETHYLENE WAX: From Japan: Associated Chemicals, 3,000 Kgs., Rs. 68,452; From USA: Savita Chemicals Pvt. Ltd., 18,000 Kgs., Rs. 5,21,178.

POLYPROPYLENE: From Japan: M.P. United Polypropylene Ltd., 30 MTs., Rs. 8,28,874.

POLYSTYRENE: From Brazil: Plast India Pvt. Ltd., 33 MTs., Rs. 7,27,005.

POLYSTYRENE HIGH IMPACT: From Brazil: Xpro India Ltd., 167 MTs., Rs. 39,22,168.

POLYSTYRENE EXPANDABLE: From Czechoslovakia: N.M. Nagpal Pvt. Ltd., 12.100 MTs., Rs. 2,78,513.

SYNTHETIC RESIN: From USA: Bakelite Hylam Ltd., 191 Kgs., Rs. 23,963; Johnson & Johnson Ltd., 1,202.30 Kgs., Rs. 59,100.

MATERIALS IMPORTED BOMBAY (From 18.5.89 to 22.5.89)

2 B ACID TECH: From UK: Sudarshan Chemical Inds., 5,000 Kgs., Rs. 5,10,000

ACRYLAMIDE: From Japan: Industrial Aids and Chemicals, 2,040 Kgs., Rs. 51,362; Shalimar Chemicals Inds., 15,000 Kgs., Rs. 3,18,654; Synor Chemicals, 15,000 Kgs., Rs.3,18,654.

ACRYLIC ACID: From Japan: Sanghi Leathers (P) Ltd., 2,000 Kgs., Rs. 63,573.

ADIPIC ACID: From FRG: Polymer Chemical Inds., 18,000 Kgs., Rs. 3,54,060; From UK: Sudhagar Rubber Inds. Ltd., 1,000 Kgs., Rs. 21,244.

ALDRIN TECH: From Netherlands: Singhat Pesticides, 5,250 Kgs., Rs. 6,51,140.

ALUMINIUM OXIDE: From FRG: ECE Industries Ltd., 250 Kgs., Rs. 42,809.

ALUMINIUM OXIDE SYN.:From USA: Grindwell Norton Ltd., 500 Lbs., Rs. 17,458.

AMINO CAPROIC ACID: From Japan: Biddle Sawyer Ltd., 50 Kgs., Rs. 22,101.

2-AMINO 6 PICOLINE: From Switzerland: Ranbaxy Laboratories Ltd., 2,000 Kgs., Rs. 3,50,914.

AROMATIC CHEMICALS: From Japan: Bharat Industrial Corpn., 200 Kgs., Rs. 1,00,332; From UK: Guest Intl. India Ltd., 60 Kgs., Rs. 2,500.

BENZALDEHYDE: From USA: C.J. Shah & Co., 16,600 Kgs., Rs.4,30,917.

BIS METHYL SILYL UREA: From FRG: Max India Ltd., 9,000 Kgs., Rs. 13,97,615.

BISPHENOL A: From Japan: C.J. Shah & Co., 16,000 Kgs., Rs.4,40,609.

BROMINE LIQUID:From Israel: S.V. Trading & Agencies Ltd., 22,680 Kgs., Rs. 5,74,596; Skylead Chemicals Pvt. Ltd., 11,340 Kgs., Rs. 2,87,298.

BUTACHLOR TECH: From USA: Herbicides India Ltd., 34,920 Ltrs., Rs. 7,30,638.

BUTYL ACRYLATE: From FRG: Ritu Chemicals, 900 Kgs., Rs. 29,316.

BUTYL GLYCOL ETHER: From France: Smit Corporation, 14,820 Kgs., Rs. 1,88,666.

CAPROLACTUM: From Belgium: Garware Nylons Ltd., 1,24,250 Kgs., Rs. 37,14,886.

PARA CHLORO TOLUENE: From Japan: Arlabs Limited, 15,000 Kgs., Rs. 3,94,161.

CITRIC ACID: From Indonesia: N. Vensimal International, 40 MTs., Rs. 6,92,384.

CITRIC ACID BP 80: From China: Sabri Textiles Pvt. Ltd., 20,000 Kgs., Rs. 2,84,922.

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2-ETHYL HEXANOIC ACID: From Sweden: Dura Chemical Corpn. Pvt. Ltd., 14,820 Kgs., Rs. 2,50,800.

FURFURYLAMINE: From France: Hoechst India Ltd., 3,080 Kgs., Rs. 2,98,072.

GAMMA FERRIC OXIDE: From FRG: Jai Electronic Inds. Pvt. Ltd., 10,000 Kgs., Rs. 4,53,280.

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MERCAPTOBENZIMIDAZOLE: From Japan: The National Rayon Corpn. Ltd., 2,000 Kgs., Rs. 3,40,309.

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3 METHYLAMINO PROPYLAMINE: From Japan: Exxon Laboratories Pvt. Ltd., 1,700 Kgs., Rs. 1,72,545.

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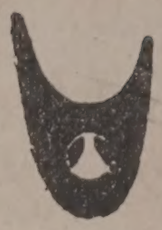

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